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The Development of Short-wave Radio Communication.

THE recent decision of the U.S. Navy Department to supply all naval vessels and shore stations with short-wave radio equipment, if its use proves reliable under all conditions, is an event of some significance. The increasing number of tests which are being carried out with waves of a length below the limit of 100 metres points more and more to their superiority over the longer waves for long-distance communication, but there is more than this one merit of greater penetrative power that suggests the desirability of their being utilised. The frequency of the impulses received in the antenna of the receiver increases proportionately as the wavelength decreases, hence much sharper tuning is possible and a greater degree of selectivity is obtained. Then, too, there is the considerable economy of power which can be effected by the use of short waves.

If the short-wave method of transmission were commonly adopted in the shipping services and the coast stations of this country, there would soon be an appreciable smoothing-out of the present chaotic state of affairs which prevails around 600 metres, which is the wavelength most frequently used by ship and coast stations. No one denies now that the 600-metre spark transmitting sets on ships are out of date. The coarse note which they transmit is almost invariably loosely tuned, and its accompanying harmonics are often strong enough to cause interference on the neighbouring wavelengths. It is said that a ship's operator can pick out and follow the particular note which he desires to read only by virtue of his intimate acquaintance with its distinctive pitch or "musical" quality, but such practice as this places too hazardous a reliance upon the skill of the operator, and renders his task unnecessarily difficult.

The objection to the wholesale replacement of ships'

spark transmitters by up-to-date equipment is, of course, the expense which would be involved, and apparently the most that can be hoped for is the gradual replacement of these sets, as they become worn out, by modern c.w. installations, probably designed for operation on short waves. In many of the French coastal stations, the expense has not been allowed to stand in the way of the complete substitution of efficient c.w. transmitters, and it seems to be the intention of the U.S .Navy Department to follow this example, but in the American case, closer attention is to be given to the utilisation of short waves.

It is worthy of note that, just as the very short waves have remarkable power for covering long distances, the long waves, especially those in the neighbourhood of 20,000 metres, have a particular utility in signalling over relatively short distances, a characteristic which probably accounts for the earlier development of the long-wave system, for it is only within comparatively recent years that serious attempts have been made to communicate by means of radio-telegraphy and telephony over really long distances. Last week we were taken to task for being "not quite fair to other and earlier" workers, in stating that the attention which has been re-directed to short waves is due to the work of amateurs. Our use of the word *re*-directed, however, indicated that we were not unmindful of previous professional investigations, but it does seem that either the deductions which followed therefrom must have been faulty, or the long-wave system was deliberately developed in preference; moreover, it is not so long ago since short waves were relegated to the use of amateur operators because they were considered to be of no particular value to anyone else.

Not quite nine months ago, we drew attention to the fact that Senatore G. Marconi "took up the systematic study of short waves in 1916, and investigations were carried out on a large scale in 1920-21, but the most important experiments have taken place during the past twelve months," *i.e.*, in 1924. It will be noted that four years elapsed between the subject being taken up and the carrying-out of large-scale experiments, and that the most important of them took place three years later still, resulting in the comparatively short-wave "beam" station proposal. Amateur workers must therefore be congratulated, not only for boldly utilising very short waves, but also on the success with which their efforts to produce results quickly have been crowned.

The British Association.

The annual "Parliament of Science" has concluded its session at Southampton, one of the most successful in its history from the point of view of the numbers attending. As we stated in our last issue, the meeting compared badly with the Southampton meeting of 1882, so far as electrical matters were concerned, but it has to be remembered that electricity in those days was an infant science with a wide future, presenting a number of problems which have now become history. To-day, although the outlook is still a broad one, electricity is established and the main business is not so much investigation and research (although these are still of the greatest importance), as development and extension. In other words, the business aspect predominates. Consequently, what little there was relating to electricity as a science was mainly concerned with wireless work, *e.g.*, the papers on "The Study of Wireless Wave Fronts by Directional Methods," by Dr. R. L. Smith-Rose and "Some Thermionic Valve Problems," by Prof. E. V. Appleton. The Engineering Section expended a great deal of its time in discussing the question of road transport; one or two mornings, however, were devoted to marine engineering matters with which the president of the Section, Sir Archibald Denny, has had a life-long acquaintance. The only strictly electrical papers were those by Mr. W. G. Turner and Mr. H. Wauchope dealing respectively with the Southampton Corporation electricity undertaking, and the electrical equipment of the docks—both of an eminently practical nature.

The popular Press has again been provided with the usual number of startling headlines—usually merely "asides" in the papers—but it cannot be said that the bulk of the matter was to be comprehended by the layman. It was one of the first principles of the Association that its annual meetings should enlighten the public as to what had been going on in the scientific world during the preceding year, but there has been a regretable tendency for the past few years to forget this. Many papers are couched in language that can only be grasped by experts in the particular branch of science which is being treated—those who may be considered to know all about the subject already. We cannot expect every scientist to have the gift of Sir Oliver Lodge and other well-known teachers, of imparting abstruse information in simple terms, but we think that a greater effort might be made in this direction.

The Lessons of the Japanese Earthquake.

Every trade report which reaches us has something to say regarding the necessity for British manufacturers to make a close study of, and adapt their methods to, conditions in each particular market. Although this generally applies merely to normal conditions, there are several countries in which the probability of the occurrence of the abnormal has to be taken into consideration. Japan is an example of this; the severe earthquake of September, 1923, and the slighter subsequent disturbances have brought forcibly before the Japanese the fact that all possible measures must be taken to render buildings and plant immune from the effects of these unforeseeable disasters.

We review in this issue a report prepared by the Japanese Electrotechnical Committee, and presented at the recent Extra-high-pressure Conference in Paris, dealing with the effects of the 1923 earthquake upon electrical installations, and containing suggestions for meeting the conditions to which Japan stands exposed.

The stations principally affected by the disturbance were hydro-electric undertakings; the steam plants in the area, although damaged, were not in use at the time, as most of them act as stand-by stations to the water-power plant. The Hakone system suffered the most, some stations being totally destroyed, while others took a long time to recover. A considerable part of the transmission systems was damaged and sub-stations were put out of action, but these required a shorter time for repair. The report deals in some detail with the nature of the damage caused to each class of building or apparatus, and an outstanding feature is the fact that rotating machinery generally remained undamaged, although in many cases its foundations were cracked.

The report presents a number of conclusions and suggestions for mitigating the effects of future earthquakes. It is stated that if proper precautions are always taken in interior wiring there is little risk of fire, and the service should be resumed immediately after the cessation of the principal vibrations. The transmission systems should be efficiently interconnected to enable the unharmed stations to take over the supply to consumers connected with destroyed stations. It has been proved that it is possible to construct sub-stations and transmission lines almost earthquake-proof; new ones should be built in this way, and steps should be taken to reconstruct existing buildings and lines to make them earthquake-proof. Special attention should be paid to the communication circuits between generating stations and sub-stations, &c. It is thought advisable to construct a loop transmission line around a large city capable of being connected to all incoming transmission lines, so that a source of supply will always be available. For public service buildings, such as water-supply stations, fire stations, telephone and telegraph buildings, &c., it is recommended that special, independent earthquake-proof lines should be installed, and emergency communication measures should be adopted.

We think that a study of some of the details of the report, particularly those relating to sub-station

apparatus, transmission equipment, and domestic installations, will be of interest and profit to British manufacturers who have business relations with Japan.

Buying a Washer.

ENGINEERS buy many kinds of washers, without thinking it necessary to keep a diary of events, or enlisting the assistance of their wives; but the purchase of an electric washer, of the sort that washes clothes, and costs from £45 to £60, is so exceptional a transaction for an engineer to be engaged in, that a complete record of the proceedings, such as that commenced in this issue over a well-known pseudonym will be found well worth perusal. Our contributor's foresight is commendable; as he points out, once an appliance has been purchased and put into use, one can never regain the point of view from which the question was originally approached. So he records his investigations and impressions from the very start, and they will be found not only interesting, but useful and suggestive to the maker and the seller, as well as the purchaser of an electric washer.

Many readers will endorse the author's remarks on the high price of the electric washer; it is certainly difficult to believe that the cost of production, even in small numbers, can be more than half the price at which the machines are offered to the public. We are not told whether the washers referred to were of British or foreign manufacture, but in view of the enormous numbers in use across the Atlantic, it would seem that the American machines are produced in bulk, and, therefore, should be cheap in comparison with those made in small numbers in this country—yet we have never met with a low-priced electric washer. It cannot be alleged that the cost of marketing the machines forms a large proportion of the price, for no one will contend that they are extensively advertised here—and our contributor's experience strongly suggests that little effort is made to induce the public to take an interest in them. Apparently the selling staff, in some of the cases he met with, cared little about the matter.

There must, however, be a very large body of potential purchasers, who only need convincing of the merits of the electric washer to make the plunge, like our contributor, in spite of the high initial cost; and the concluding portion of his article, in which he demonstrates the remarkable economy effected by the washer, which pays for itself within twelve months, should go far towards that end. It is true that the washer load is of little value to the supply authority in itself, but the same might be said of the electric iron and the electric kettle, which are well-known to be most effective promoters of the domestic load in the aggregate. Similarly, the electric washer, which is emphatically a labour-saver, would strengthen the case for the electric way in the house where it was used, whilst it would also form so fruitful a topic for conversation that it would become an invaluable advertising medium in the neighbourhood, especially in view of its rarity in British households at present. We therefore commend the article to the notice of our central-station readers who, if they are not interested in the promotion of the domestic load, ought to be.

A London Goods Railway.

ACCORDING to reports in the Press, proposals are under consideration for the construction of a network of underground goods railways, connecting the London termini with the docks and with the principal distributing centres. The project is estimated to cost £32,000,000, and a promotion company has been formed to obtain the necessary statutory powers.

It can hardly be doubted that such a railway would be of immense benefit to the metropolis, in which an enormous amount of goods traffic is carried on; not everyone knows that the Port of London is the principal seaport of this country, its annual aggregate tonnage entered and cleared exceeding 20,000,000 tons. There is also a vast amount of goods traffic between London and the provinces by land, as well as internal traffic between the various members of that overgrown agglomerate of cities, which might be most conveniently handled underground, relieving the congested streets of much of their present burden. The scheme includes the construction of a huge central underground station, to serve as a clearing house, which reminds us of the ingenious project put forward by Mr. Gattie years ago; impracticable as a surface proposition, the Gattie scheme might be worthy of consideration in connection with underground goods railways.

If the proposals are carried into effect, the railways will, of course, be operated electrically, and will also offer a considerable demand for electricity for lighting and power. It is interesting to recall that a similar network of railways has for many years been in operation in—or rather under—Chicago; in that case, we believe, the tunnels were already in existence, and thus a considerable economy was effected. The Post Office has also led the way by constructing a tube railway from east to west for its own purposes, which is approaching completion. The scheme certainly appears to be worthy of close examination, and we trust that it may prove capable of solving, at least in part, the perennial problem of London's traffic congestion.

Service and Advice.

WE may be excused for turning once more to this subject if we point out that according to the best authorities the success of electricity in the United States, which is constantly held up to us as a model, is mainly due to the way in which the various branches of the electrical industry have hastened to serve consumers' interests and advise upon the best methods to adopt. New phases of the matter are constantly coming to light in the United States, and it may be of interest to mention two of the latest. The first is the cost of electrical service, with particular reference to cookers. The National Electric Light Association recently collected data from a typical central-station company with 4,000 cookers on its system with a view to ascertaining the cost to the company and the benefit to the consumer. This company makes no charge for "servicing" cookers, no matter how old they are, and the approximate cost of this arrangement is about $20,000 per year. In 1923 there were 2,348 cookers in use, and 6,059 complaints (2.5 per cooker) were received and disposed of at the cost of $2.57 per complaint. In 1924 the number of cookers rose to 8,956, and the number of complaints to 3,972; the cost per complaint, however, fell slightly to $2.45. There is a fear that this form of service will ultimately prove very expensive to the company as the appliances in use grow older; unless some sort of charge is made, consumers are apt to be careless in handling their cookers and call in the company's men for the most trifling things.

Another matter which has recently been discussed at considerable length in the United States is the providing of illumination advice to the consumer. In this country a great deal is being done by the Electric Lamp Manufacturers' Association. (It will be understood that free advice is meant, as apart from the engagement of professional consultants.) The view adopted in the United States, however, is that as the supply companies gain most from electric lighting, they should provide most of the free advice to consumers.

The *Electrical World* says that a survey has indicated that less than 10 per cent. of the users of light who actually seek advice go to the electricity supply company for it, although, it is said, 90 per cent. of the cost of lighting is due to the electrical energy consumed. The supply companies should, therefore, supply a similar percentage of the advisory service, but in spite of this, few American companies have lighting departments and fewer still are able to take care of 90 per cent. of those who now seek advice. We would not like to say how far American conditions are on all fours with conditions in this country, but we think that our own supply authorities could do a great deal to improve illumination, and, incidentally, benefit themselves, by advising consumers as to the best methods to adopt. No doubt E.L.M.A. would render assistance to this end.

The Wynau Power Station.

Some Particulars of a New Propeller-Type Turbine.

THE capacity of the old power station at Wynau, Switzerland, having become insufficient to meet the electricity requirements of the district, the directors of the Société des Entreprises Electriques de Wynau some time ago decided on the construction on the left bank of the river of an entirely new hydro-electric station of 10,000 h.p. capacity, the power being obtained from the same barrage as the station on the right bank.

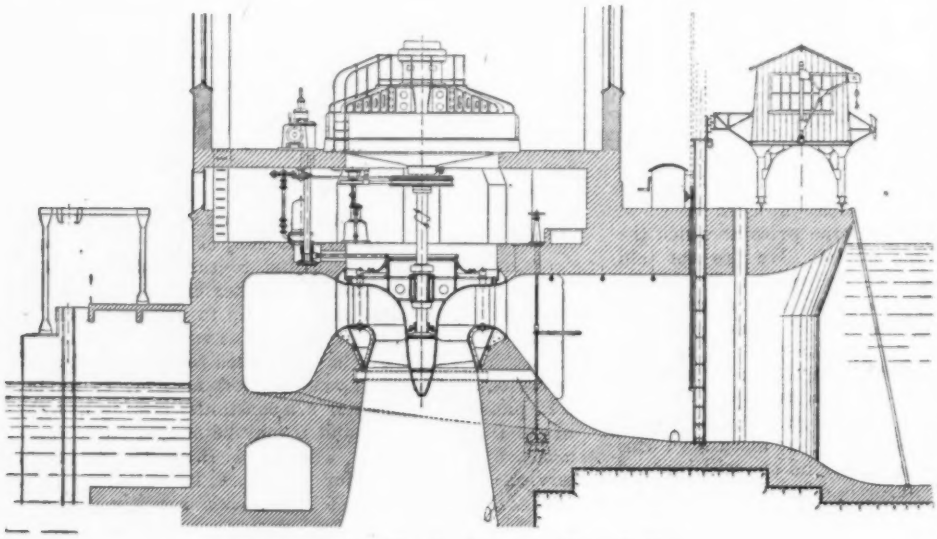


Fig. 1.—Sectional Elevation of one of the Wynau Turbines.

The turbines of the original plant, which develop 860 h.p., drive the alternators through the medium of somewhat large conical bevel gearing. To overcome the drawbacks of this method of driving, it was decided, for the new plant, to take full advantage of the latest turbine practice and to equip it with turbines having wheels in the form of ships' propellers.

The principle of this type of turbine is an old one; the early Jonval turbines, for example, were fitted with impelling wheels, on the periphery of the inner rim of which a series of blades was mounted. The curvature of the blades was mounted somewhat acute, on account of the relatively low peripheral speed possible at that time; not only so, but the water was conveyed to the rotor by an axial distributor not well suited to vane adjustment. As far back as 1860 an American inventor of the name of Traux patented a turbine with a four-blade propeller without an external rim, the water being led to it by a spiral-shaped chamber. Horton, in 1877, and Williams, in 1893, also both designed turbines with impellers of very much the shape of ships' propellers, but provided with subsidiary blades shorter than the circumferential space between two consecutive main blades.

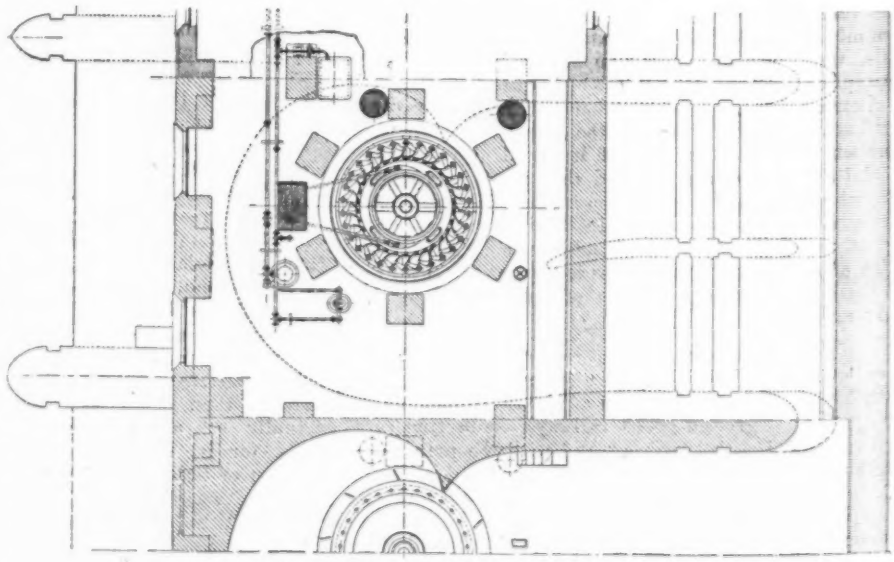


Fig. 2.—Plan of one of the Wynau Turbines.

The development of the Francis turbine with centripetal admission and axial outlet led, however, to the abandonment for a time of the propeller turbine.

The object of all propeller-type turbine designers has been to increase the speed in order to permit of the direct coupling of electric generators and so effect a reduction of installation costs. In order to diminish the friction due to the higher speeds, the number and length of the blades have been reduced, and to prevent any eddies a more simple and less curved shape was given to them. Due, finally, to the progressive reduction in the diameter of the disk hub, to which the blades are fixed, a return has been made step by step to the shape indicated, as mentioned above, by Williams and Horton. It is mainly to the efforts of the American engineer Nagler, of Milwaukee, and of Prof. Dr. Kaplan,* of Brunn, that the modern improvement of this type of turbine is due. Following the excellent results secured, and published by Kaplan, most turbine manufacturers recommenced the construction of screw-type turbines. The Société des Ateliers de Constructions Mecaniques, of Vevey, Switzerland, which for a long period has experimented with high-speed turbines, made some trials in its experimental department with one of these screw wheels of a diameter of 380 mm. (practically 15 in.), and it was as an outcome of the results of these tests that the Wynau Co. placed an initial contract with the Vevey Co. for two screw-type turbines designed to work with water at heads varying

* *See* World Power Conference Paper No. 64, "Historical Note on the Kaplan Turbine," by Dr. Ing. S. Kneidl.

from 7¾ to 17 ft., and to develop a maximum of 2,700 h.p. each at a speed of 107 r.p.m.

Figs. 1 and 2 represent the elevation and plan, and fig. 3, is a general view, of one of the Wynau turbines. Each turbo-alternator set is provided with three main bearings, of which two are embodied in the alternator. The thrust bearing of the turbine, mounted on the cover of the distributor, is of white metal lubricated with oil circulated by a small pump driven by gearing off the turbine shaft. The water is conveyed to the distributor by means of a cement spiral chamber, the inlet to which is symmetrically arranged in order to facilitate, by the elimination of eddies, the regulation of the water delivery by means of the usual vane wheel. The frame-work of the turbine, which is of heavy construction and consists of two cast-iron rings held together by 10 columns cast with them, supports the turbine, the alternator, part of the flooring, and also the load of the pivot. The shape to be given to the outlet pipe was the subject of much special study by reason of the considerable speed possessed by the water on emerging from the driving wheel, which corresponds to one-fourth, and even one-third, of the total energy. A special diffuser was finally adopted to enable the greater portion of this residual energy to be recuperated. The driving wheel is a single steel casting, and is composed of a hub with four blades without a peripheral rim, the shape being, as indicated in fig. 3, roughly that of a ship's propeller. The diameter is, however, slightly greater at the exit edge of the blades than at the entry edge; they are relatively long to facilitate the guiding of the liquid stream and to prevent eddies. The wheel, which is bolted up to a coupling disk, forged in one with the turbine shaft, rotates in a readily dismountable cast-iron casing. When it becomes necessary to dis-assemble the alternator, the wheel, together with the shaft, can be supported in channels formed in the walls of the cement outlet pipe. The rotor of the alternator can be supported on a bottom crossbar by means of jacks provided for the purpose.

The water distributor, which is of a type similar to that of the Francis turbine, consists of a bottom ring carrying the conical casing of the impelling wheel, a top cover and 30 pivoted cast-steel vanes. The turbine framework and distributor are divided axially. The journals are in one piece with the vanes and work in bronze guides. The upper journals pass through the distributor cover and carry at their extremities adjusting levers connected with the sluice-control rings by small bronze connecting rods, the latter being made flexible in order to prevent undue wear of the vanes should any foreign body penetrate between them at the moment they are closed. The pivot of the main shaft mounted on the cross member of the alternator supports not only the weight of the rotating portion of the turbine and alternator, but also the axial thrust of the water on the driving-wheel, it being possible for the load to reach a total of 82 metric tons. It is of a type patented by the Vevey Co., the object being to ensure a uniform division of the load on all the segments and over their entire width.

With regard to the control of the turbine, the regulator, mounted in the alternator room, comprises a framework which forms an oil reservoir, a servo-motor, and external control apparatus. The servo-motor, which has a differential piston, acts, on the one hand, on the delivery to the pivoted vanes of the distributor, and, on the other, by means of a cataract and a system of rods on the compensating orifice (pressure regulator) in the chamber below the turbine. The servo-motor is controlled by a governor connected with the distribution valve; a small auxiliary servo-motor is also provided so that all that the governor—which is enclosed and driven by belt off the turbine—does, is to move a small adjusting needle. The regulator is also provided with two special fittings, one of which allows the turbine speed to be controlled from the switchboard, while the other enables the speed to be reduced while the turbine is running. Each of the two turbines is provided with a couple of safety devices; one effects the automatic closing of the turbine should the governor of the regulator cease to function owing to seizing or belt troubles; the other consists of a centrifugal regulator fixed on the turbine shaft and so set that should the speed exceed 120 r.p.m. a catch, which is connected with the oil distributor of the regulator, is released, so causing the stoppage of the turbine. The two initial screw turbines at Wynau were put in operation in October, 1923, and were run by the Vevey Co. until the reception tests were carried out in January, 1924, under the direction of the Hydrometrical Bureau of the Swiss State Water Service, the power developed by the alternators being measured by officers of the Testing and Standards Station of the Association Suisse des Electriciens. The tests showed that with a head of 17 ft. a maximum efficiency of 89 per cent. was attained. At a specific speed of 728 r.p.m., and at a specific speed of 862 revolutions with a head of 4 metres (13 ft. 1½ in.) the efficiency was 86 per cent. Although the available head at Wynau ranges between 7¾ and 17 ft., the variations in delivery are only about 8 per cent. With a 16½-ft. head and working at full load, the turbines develop 2,730 h.p. at 86 per cent. efficiency, while at seven-eighths load an efficiency of 87.7 per cent. is attaned.

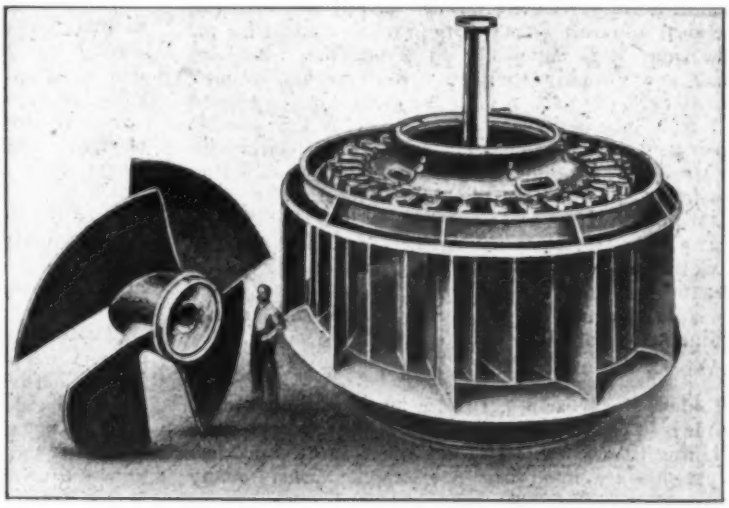


Fig. 3.—General View of one of the Wynau Turbines.

As a result of their satisfactory operation an order for two additional turbines for the Wynau station has recently been placed with the Vevey Company, which summarises the advantages of the propeller turbines as follows: They are particularly well adapted to utilise at a minimum cost the power of rivers in plains, furnishing large volumes under low heads, and also in cases where there is much variation in the head of available water. As compared with the Francis type, higher speeds are possible, reducing the cost and size of the alternators, and also the size of the power station buildings. Not only is the efficiency, when working at from three-quarters to full load, high, but the higher angular speed of the alternators also increases the efficiency of the latter. Finally, owing to the wheel having only four blades and these cast *en bloc* with the hub, it is claimed to be stronger than a Francis wheel.

American Electric Vehicle Exports.—During June last 20 industrial electric vehicles valued at £4,616 were exported from the United States, as compared with only 8 (£1,243) in the corresponding month of 1924.

Choosing and Using an Electric Washer.

Diary of a User's Experience.

By "WREN."

DEPRESSED by the shortage of competent and trustworthy domestic labour—unemployment figures notwithstanding—and alike oppressed and incensed by the charges of, and services rendered by, steam laundries, hand laundries, and their kin, the writer has decided to investigate the possibilities of electric washers. Please note the tense of this announcement! At the time of commencing this article the washer has not been purchased, not even chosen, but it seems evident that if this record is to be of help to others it must be made in the form of a diary. Once a washer—or any other piece of electrical apparatus—has been purchased and used for some time, it is impossible to regain the standpoint which one formerly occupied. However honest one's intentions, notes written after the event must be affected by the lessons of experience. Hence, at the possible expense of other considerations, this record starts with the writer as an interested and hopeful inquirer. How it will end remains to be seen, but, if the Editors of the ELECTRICAL REVIEW will permit it, it shall be published as it stands. Perhaps users of other electrical appliances will present their experiences on the same system. A contemporary record written each day, or week, from the experience of that period must have certain merits attainable by no other means.

The First Step.

To-day, December 8th, 1924, a long series of "Black Mondays" has culminated in one blacker and more fatiguing than usual. Also Christmas and the problem of presents are upon us. Are electric washers really any good and, if so, can we afford one?

A mental review of our acquaintances reveals the fact that none has an electric washer. This looks suspicious, especially as we have noticed machines more or less casually at exhibitions for years past. On the other hand, reliable reports from Canada and the United States say that hundreds of thousands of electric washers are used in those countries, and periodic "washer campaigns" by central station authorities add hundreds of washers a month to the mains.

Evidently there must be something in the washer *per se*, whatever the reason for its rarity in this country. Inquiries from the local electricity offices and from Mr. J. W. Beauchamp, of the Electrical Development Association, bring forth a list of reputable makes and also make clear the probable cause of the fewness of electric washers in British homes. It is a matter of first cost. The energy consumption is a negligible item—less than that of an electric iron—but the initial outlay of forty, fifty, or sixty pounds for a "first-class machine" and of, say, twenty-five pounds for a "mechanical washer fitted with a motor" is rather staggering.

Still, money is cheaper than flesh and blood, so we will proceed, a little less exuberant than before, but still hopeful that, either by outright purchase or some form of "easy payments," we may acquire a machine to perform the most irksome of all domestic duties. A few minutes on the telephone and the good offices of the friends mentioned have given us a start and provided us with information on which to base a tour of inspection.

The local electricity supply office—in a London borough of 100,000 population!—is perfectly courteous in the matter, but has only one copy each of the pamphlets describing three different makes of washers. These are lent to us on the understanding that we will *return them some time when passing*! Evidently anyone else in the neighbourhood who contemplates the purchase of a washer will have to wait till we return the pamphlets. No doubt the makers of the machines would supply a thousand copies of these descriptive leaflets to the electricity department on demand, but, in this district at any rate, it is evidently no one's business to advance the cause of the electric washing machine. The nearest machine on view in an electricity showroom is five miles away, so we are informed. As there seems to be some doubt on this point, we decide to visit the maker's showrooms.

Viewing Machines.

Without mentioning names, for to do so might lead to invidious distinctions, the first firm visited may be termed Messrs. A. Two machines were on view in an admirably-appointed showroom, but neither machine could be seen in action—disappointment No. 1 from our point of view, mistake No. 1 from the seller's point of view. However admirable the verbal explanation, we would have liked to see in action the machine for which we were asked forty-five pounds. Even in the case of the cheaper equipment, costing a mere ten or twelve pounds, a little electricity, a few clothes, and an actual demonstration of what could be done in ten minutes would have been both interesting and convincing.

However, no signs of a demonstration being forthcoming, we proceed to inspect the inanimate machine. The demonstrator appointed to assist us—possibly not the regular demonstrator, but still the person entrusted with the potential sale of an expensive machine—is most courteous and, up to a point, helpful, but does not know: (*a*) Where the emptying cock is—or even if there is one at all! (*b*) What power the machine absorbs. (*c*) What is the purpose of a certain device which, we soon find out for ourselves, is designed to release the pressure on the wringer rollers instantly in case of emergency. (*d*) Whether the wringer can be fixed in any desired position and, if so, how. (*e*) How a certain important pair of gears is lubricated. All of these problems we were able to answer for ourselves, but it ought not to have been necessary for us to do so—mistake No. 2 from the seller's point of view!

Also, though this machine has well-arranged switches and gearing, the demonstrator shows no response to our suggestion that we should like to look inside. If there is any reason why the covers of this particular machine cannot be removed, surely specimen switch and gear boxes could be kept permanently open for inspection! Mistake No. 3 for the seller.

A visit to Messrs. B. reveals another machine similar in many respects to the one first seen, and in this instance there is no hesitancy as to the location or purpose of any part. There is again no demonstration of the machine in action, but—important advance—there is a pressing offer to have the machine demonstrated in our own home. This offer we decline with thanks, feeling that we should be committed to some extent did we accept. Still, we should like a demonstration, and it ought to be on the seller's premises. Electric vacuum cleaners are performing all sorts of marvels over the way, so why cannot the electric washer be dealing with some of the staff laundry?

Messrs. C. bring to our notice a comparatively inexpensive equipment, with no wringer, it is true, but, on the other hand, it washes the clothes and boils them at the same time. This seems to be an advantage, but: (*a*) We have a gas-heated "copper" already, and (*b*) we happen to know that electric heating is rather expensive when gallons of water in an unlagged vessel are concerned—by the way, the demonstrator does not point this out. He ought to do so—it is a fact which could not be concealed once the meter had been read!

In view of the great difference in price between this and the other equipments so far inspected—some £35 *difference*—we do a little mental arithmetic. The expensive machines consume about 200 watts, *i.e.*, half as much as our electric iron, and could be run from a lamp socket. The cheaper outfit consumes 2,000 watts and would involve a power cable; on the other hand, the latter would give us the benefit of the power tariff of 2¼d. per kWh instead of 7d. as for lighting. Per hour of use, the dearer machine would cost 1.20d. and the cheaper one 4½d. for energy alone. This is a considerable difference, but it would take $\frac{35 \times 240}{(4.5 - 1.2)}$ or 2,550 running-hours—about 16 years at three hours a week—to save, on the energy bill, the extra cost of the dearer machine. Having the advantage of a slow-combustion anthracite stove which provides abundant hot water at the cost of a few pence per day, we could eliminate the use of the electric heater for bringing water up from cold, so that the actual energy bill would not differ so much between the two equipments as would at first sight appear to be the case.

Here, however, the feminine member of our committee of two steps in and asserts that in her opinion—which is, of course, final in such matters—the motor-driven washer will deal with more clothes, and more effectively to boot. Also, it gives the advantage of a motor-driven wringer, which is no small consideration.

Thus ends the first day's inspection—definitely in favour of a motor-driven washer and wringer. From the excellent workmanship of the machines so far seen, and bearing in mind that they embody a first-class ¼-h.p. motor, a substantial washing vessel and cylinder, a first-class wringer, and the requisite gearing and switches for automatic washing and for wringing in either direction from any angle, it is already evident why the first cost is high. The equipment and the facilities offered exceed our expectations, but, more than satisfied though we be on these points, it is evident that electric washers cannot be used extensively in this country until the price is reduced—and if they were in general demand the price would doubtless be lower. Once again the vicious circle of high price and limited demand appears and, as in other cases, its paralysing consequences must be broken by the price being first reduced so as to increase the demand.

From a consideration of the retail prices of the principal components of an electric washer it would appear that the amount charged for these machines could quite well be reduced. The following retail prices have been quoted to the writer to-day:—

¼-h.p., d.c. motor, from £5 15s. to £8 10s.
Wash-tub on stand, from £1 15s. to £2 5s.
12-in. wringer with rubber rollers, £1 10s. to £2.

Doubling the price of the wash-tub to allow for the cylinder of an electric washer, the sum of the above three items is from £10 to £15. The difference between these figures and that of from £45 to £60 asked for complete electric washers is from £35 to £45, surely an excessive amount for the gearing and assembly of the components.

Consumers, as a class, cannot afford the high-priced washers of to-day, but manufacturers can afford a temporary loss—or rather an investment—on bulk production of a low-priced machine of high quality. That an adequate demand would be forthcoming cannot be doubted.

Already, it will be perceived, the writer is an enthusiastic believer in the electric washer. It only remains to decide which machine shall be purchased.

Constructional Faults and Merits.

Since writing the preceding section, several more machines have been seen and several showrooms have been revisited in order to confirm, or correct, first impressions in the light of further experience. As a result, many points have been noted, and it may help potential users to have a summary of constructional faults and merits as seen by the writer and his wife from the engineering point of view and from the standpoint of the user respectively. In stating what, in our opinion, are good features and what weak, mention of specific makes is purposely avoided. No machine seen possesses all the good features, and none all the drawbacks cited.

Desiderata in Electric Washers.—In point of electrical and mechanical safety, all the machines inspected reach a high standard. The risk of shock appears to be definitely eliminated and it is, of course, essential that this should be so in a machine which may be used on damp stone flooring and supplied from 200-250-volt a.c. mains. The motor should be definitely insulated from the frame of the washer by mounting the motor on an insulating base and connecting it to the load through an insulating belt or coupling.

The use of sheet-metal doors to protect the motor completely from splashes of water, whilst eliminating the risk of skirts being caught by rotating shafts, belts, or couplings, is a good feature. Naturally, such doors should give complete and easy access to the motor when desired. Some form of clutch must be embodied between the motor and load, and it appears to matter little whether this is in the form of a friction clutch, or of a belt which serves as a clutch whilst taking the place of part of the speed-reducing gear otherwise required.

The duty to be performed in most of the machines inspected is the oscillation of a relatively heavy cylinder through water, which adds to the inertia to be overcome at the moment of reversal. The nature of this drive, together with the conditions of service and the more or less unskilled manipulation to be expected, makes it desirable that gears, clutches, and other parts of the mechanical transmission should be of relatively heavy construction. The gears must be machine-cut and thoroughly lubricated, otherwise the frictional loss becomes excessive.

A press-button switch on the washer itself (in addition to the wall-plug switch) is desirable in the interests of economy and safety. All mechanical controls should be conveniently situated; easily manipulated when the hands are wet; not liable to be displaced accidentally; and capable of movement without risk to the user or the machine, whatever the position or state of motion of the component parts. Preferably, it should be possible to lock the wringer in any position with regard to the vertical axis round which it swings.

Some place or method for supporting the "lid" of a washing cylinder without dripping on to the floor whilst emptying or filling the machine is an obvious convenience, but one which is not always provided. An indication of the correct water level given inside the washer is much more convenient than the usual filling line marked on the *outside* of the container.

Limitations or Defects Noted in Existing Machines.—The sheet-metal door enclosing the gearing of a certain machine is secured by a catch which is very easily displaced. It is conceivable that this might lead to a nasty accident, especially as the catch must offer temptation to a young child. A limitation common to most of the oscillating-cylinder machines inspected is that no provision is made for fitting the drain cock at the other end of the machine if desired by the user. This is not so trivial an objection as it may sound, for in these days of diminutive houses it is not always easy to move the machine for connecting a hose pipe to the existing outlet.

In one excellent machine the main control handle is distinctly liable to catch the knee or leg of a passer-by; apart from any discomfort thus occasioned, there are the unpleasant possibilities of unexpected starting or stopping of the machine. In another machine the control handles are arranged very neatly, but on attempting to use them the writer found that their clearance was insufficient; a bruised thumb was the result, and had the skin been softened by moisture the mishap would have been more painful.

The press-buttons on the washer (for starting and stopping the motor) are sometimes placed where they might be actuated inadvertently by the user leaning

over the machine. One of the main advantages of press-button control is sacrificed if the buttons are not placed in the most convenient situation.

The method of securing the lid or door of the washing cylinder itself is generally good, but in one machine an extraordinarily primitive device is employed. The consequences of the lid coming off whilst at the bottom point of its revolution can be visualised so easily that there is no excuse for providing an inadequate latch. In some machines the details of the safety pressure-release on the wringer are so much inferior to those of other makes as to be reckoned a defect when making a critical comparison.

Grease cups and grease-packings are used extensively on electric washing machines, and in most cases they ensure satisfactory running for long periods with a minimum of attention, but in several machines there are a few parts which require much more attention than the rest and—this is the point—there is no apparent reason why these parts also should not have been made self-lubricating.

Separate pressure screws at each end of the wringer rollers introduce the risk of applying uneven pressure. A single central device for applying pressure, with equalising bars in the mechanism, would be preferable, provided that it could be combined with reliable means of releasing the pressure instantly in an emergency. A safety device to prevent fingers being trapped by the wringer rollers would presumably be compulsory in any machine with similar risk for use in factories, and there seems to be no reason why it should not be embodied in clothes wringers for domestic use. The risk of such an accident occurring is quite appreciable. Machines which have not a flat top for use as a table during 6½ days of the week are at a definite disadvantage, particularly in the small home where space-sparing is the guiding principle of the architect, and hence, perforce, of the householder. The complete enclosure of the framework or stand of the machine appears to be desirable on grounds of cleanliness. The open lower framework of some machines offers many lodgments for dust and many corners which are difficult to clean. A plain sheet-metal enclosure affords protection in both directions and is easily wiped down.

(To be concluded.)

The Hydro-Electric Exhibition at Grenoble.

By Our Special Correspondent.

AN important exhibition was opened in May at Grenoble, in the French Alps, a noted centre of development in connection with hydro-electrical engineering, and a favourite holiday resort, the town being situated in a district of exceptional interest and beauty. A large block of buildings has been devoted to exhibits of water-power plant, in which most of the space has been taken

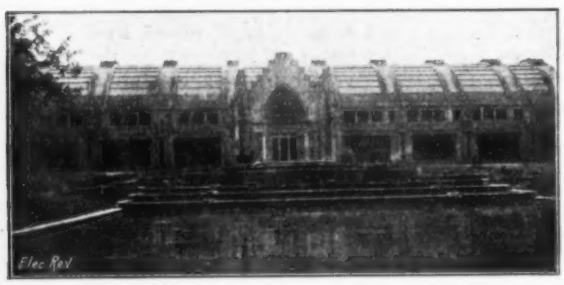


Fig. 1.—Water-power Section of Grenoble Exhibition.

up by French makers of such machinery and accessories (fig. 1); heavy turbine plant has been installed in an annexe.

The exhibits are to a large extent made up of contour models, photographs, and diagrams, the photographs being, as a rule, very well done. Some of the most interesting exhibits are those of companies in districts where water power is linked up with steam-power stations.

French Water-power Areas.

One can see that, so far as present development and future possibilities in France are concerned, the Rhone, with its numerous tributaries from the Alps, easily takes first place, followed by the Pyrenees and then by the watersheds of rivers having their sources on the southern and western sides of the great Southern Plateau, between the Loire, the Garonne, and the Rhone. The Dordogne, which runs for many miles through a sort of chasm, is one of the rivers which are being utilised in this last district.

Contrary to what one would suppose, there is but little water power on the western side of the Vosges, although on the eastern side there are some important installations, and there is evidence that on the Alsatian side of the Rhine from Strasburg to the Swiss frontier very important developments will take place in the near future in relation to a combined canal and water-power project.

In the northern districts there is very little scope for water power, although development will take place shortly in the valley of the Chevreuse, the pretty rural district near Versailles.

In the Alpine districts of France the glaciers form in many cases natural reservoirs, which tend to reduce the seasonal variations. In the Alpine, Pyrenees, and Central Plateau areas the water has, in many places, cut deep gorges through sound rock, so that large quantities of water can be held up with short dams arched in plan.

The linking-up of the Rhone valley from the Swiss frontier near Geneva to its mouth is going ahead slowly but surely, the canalisation of the river for heavy barge traffic forming part of the scheme; the construction of a tunnel for 1,400-ton barges into the Marseilles docks is one of the most remarkable engineering undertakings going on in Europe at the present time.

If one can judge by photographs and exhibits of steel towers, a number of installations are in progress at from 90,000 to 150,000 volts; it is interesting to note the way in which certain national tendencies influence design, some of the long-span towers being somewhat over-elaborate and expensive in design, whilst others are of the less expensive American type.

Italian Power Companies.

The Italian power companies and manufacturers have made a valuable contribution to the Exhibition, a special building being set apart for their exhibits. At first sight one would think that the water-power developments would be almost confined to the northern Alpine glacier-fed districts, whereas, in fact, great developments have taken place in Southern Italy, Sicily, and Sardinia in districts supposed to be poverty stricken, large bodies of water being held up by dams which make artificial lakes, irrigation going hand in hand with the electrical developments. An interesting and ingenious diagram is to be seen in this section. By means of miniature red and white coloured lights to denote steam- or water-power stations, placed on a large-scale relief map of Italy, which lamps are switched on in groups, the progress of electricity supply from 1895 to the present day can be seen in five-year steps. The progress of the last few years has been remarkable.

In the same section the firm of Marelli has an interesting stand, on which are to be seen a 2,000-kVA. 55,000/6,600-V. 3-phase transformer and a small turbo-

generator; a number of table and other fans represent a line of business in which this firm has obtained an important position.

Another firm that has a reputation outside the limits of Italy is that of Richard-Ginori, a concern that has been for many years a manufacturer of high-class porcelain ware, and, like the Frank Haviland Co., of Limoges, has taken up the manufacture of porcelain insulators. This firm exhibits pin insulators for a working pressure of 80,000 volts, although some power concerns in England and elsewhere begin to use suspension insulators at about 30,000 volts. There are also on view several types of suspension insulators by this maker for very high pressures.

Swedish Section.

A wooden building of an artistic character is used to house the Swedish exhibits. A special feature is a panorama of part of the Gellivara Railway, which trans-

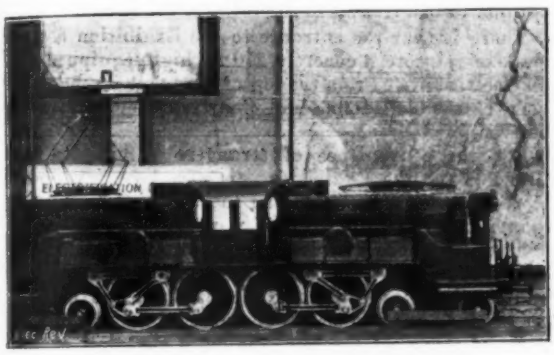


Fig. 2.—Model of Locomotive for the Orleans Railway.

ports iron ore to the ice-free port of Narvic over the Norwegian border. This railway is within the Arctic circle. A large model is exhibited of an articulated locomotive used on the railway; it is equipped with electrical apparatus made by the Swedish General Electric Co. Photographs and diagrams are on view of a number of typical Swedish water-power undertakings, among them Trolhattan and Porjus.

There is also a building devoted to the travel and water-power exhibits of several foreign countries, among them Poland. At first sight one would think that there could be but little water power available in that country. The Germans in East Prussia have developed the several low falls on the basin of the Baltic, and in Poland the same thing is taking place. The south of Poland, which borders on part of the Carpathians, is mountainous, and some high falls are already being utilised. There are some exhibits in the same building in connection with Norway and Germany.

Railway Section.

The section devoted to railways is of considerable interest, several heavy electric locomotives being placed in a wide and lofty building.

At the time of the writer's first visit, some of the locomotives belonging to French railways had not arrived at the Exhibition, although there were two of note—one of the French State railways for working in the Paris western suburban area, and the other of the Midi Railway, which covers the district from Bordeaux to Toulouse and Biarritz and the Spanish frontier. The former is a direct-current, 8-wheel locomotive suitable for 750 or 1,500 volts; it is one of 30 being supplied largely for hauling long-distance and other passenger trains from the Underground Invalides station in Paris to Versailles-Chantiers station. This duty is very similar to that performed by the latest type of Metropolitan Railway electric locomotives, which haul long-distance trains over the electrified section to a point where steam locomotives are attached. The locomotive is fitted with four geared axle-hung auto-ventilated motors each of 275 h.p. on a one-hour rating. The maximum speed is about 70 miles an hour, the maximum tractive effort is 12 metric tons, and the total weight is 62 metric tons. It was made by Messrs. Schneider, working in conjunction with the Jeumont and French Thomson-Houston companies.

The Midi Railway shows one of its high-speed passenger 4-6-4 electric locomotives made by the Constructions Electriques de France, of Tarbes. It is fitted with the "English Electric" system of camshaft control and vertical geared motors. As compared with locomotives with side-rod and crank drive, the Midi locomotive looks less complicated, and as compared with the State Railway locomotive above described, it has the feature of external neatness which would appeal especially to English locomotive engineers.

There are also several interesting locomotive models shown by the Orleans Railway. Fig. 2 shows a model of a type of locomotive being built for this company by Ganz.

Italian Locomotives.

The Italian Government Railway Department exhibits three heavy locomotives. They are made by the Ansaldo, Italian Westinghouse, and Ernesto Breda companies respectively. All three are for use on the three-phase railways in Northern and Central Italy, where long and very heavy gradients and frequent tunnels have to be negotiated. The three locomotives have certain features in common: two large motors each coupled by cranks and side rods and connected to the driving wheels by coupling rods, links, or grooved slots; liquid starting resistances and switchgear in general operated by means of compressed air. They have many points of resemblance to the locomotives developed for the Valtellina Railway about 25 years ago.

The locomotive of the Ansaldo Co. has 10 coupled wheels driven by two three-phase motors of 1,200-1,300 horse-power each, 16⅔ periods. The two motors can be put in parallel or in cascade; they are connected directly to the line at 3,300 volts. The reversing is carried out by six vertical plungers arranged in a circle making contact with six tubes, the reversing being carried out by dropping and revolving the plungers and then lifting them into contact again, operation being by compressed air. The locomotive has a weight of 75 metric tons and 12 metric tons draw-bar pull. Many of the features of all three locomotives show the influence on design of the six-coupled locomotives first used on the Valtellina line twenty years ago. In order to enable stators of maximum width and power to be placed between the main frames of this locomotive, the slip rings

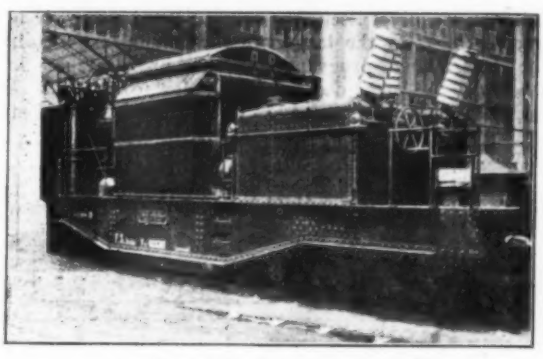


Fig. 3.—Portable Transformer Substation.

are put outside the frame and outside the cranks of the combined rotor and jack shafts; these rings are covered with sheet-steel guard cases and are very accessible. There are two 12-kVA transformers for the supply of low-pressure current for lighting, the operation of air compressors, and other auxiliaries. The resistance for starting consists of a liquid contained in a riveted steel tank with a diaphragm across it; the phases are connected to triangular plates made of an iron alloy. The liquid, which is a mixture of soda and water, is driven up into the resistance chamber and into contact first with the points of the plates and then with the full width, the plates then being automatically short-cir-

cuited. The whole arrangement of the resistance is simple; it forms a striking contrast to the complicated connections and resistances required for some modern d.c. contactor gears.

Considering the great simplicity and operating success of this type of displacement liquid resistance in connection with three-phase motors of large capacity which has now been in use in Italy for 25 years, it is remarkable that so little use has been made of the system in industrial work. Perhaps like the passive opposition which at times took place in official circles during the war to simple contrivances, some people may prefer to fry more expensive fish than is always necessary.

There are 100 locomotives of this type operating heavy goods and "omnibus" trains on sections with heavy gradients up to 1 in 36 near Turin. It is understood that these comparatively simple three-phase locomotives have proved to be efficient in practice and economical in upkeep costs. The motors are ventilated with fan draught.

There is also a 75-ton 6-coupled locomotive made by the Italian Westinghouse Co. of a type which has done good service for some time. It is arranged for four speeds. The motors can be connected up as 8-pole machines with 3-phase windings or as 6-pole with 2-phase windings, the change being made by Scott transformer connections. The locomotive itself is of the 1914 type, but a new kind of link work has been adopted which is lighter than that fitted to the other Italian locomotives on view.

16⅔- and 50-cycle Locomotive.

The third Italian locomotive, that of Ernesto Breda, of Milan, has some novel electrical features. It is designed for regular operation on a three-phase circuit at 10,000 volts, 50 cycles, the supply being from power stations which also carry an industrial load. The locomotives are designed so that they can operate without material loss on a 3,300-volt 16⅔-cycle circuit. The two driving motors, which are of 1,300 h.p. each, are geared to jack shafts by double gearing and connected to the driving wheels by coupling rods. For 10,000-volt circuits a transformer is used.

Travelling Sub-Station.

The Italian State Railway Administration has also on view a transformer sub-station on a railway truck, fig. 3, for use with three-phase circuits of 102,600 volts, with star connection, or of 59,300 volts when in mesh. The secondary pressure is 3,700-4,460 volts. A triple-tank, 3-pole circuit breaker, an oil-immersed transformer, and a small operating cabin are fitted on the truck frame. It is made by the Officine de Savigliano, of Turin.

There is a long building to be devoted to applications of electricity, but at the time of the writer's visit things were not sufficiently far advanced for a very definite opinion to be given as to the value of the exhibits.

There is near the entrance to the Exhibition a tower made of reinforced concrete 270 ft. high, equipped with an electric lift. From the top of the tower a remarkable view of the Belledonne and Chartreuse mountains can be seen.

For the convenience of strangers wishing to visit Grenoble for the Exhibition, an office has been opened at the P.L.M. railway station to enable accommodation to be procured without difficulty or delay.

Since the above was written, information has come to hand that one of the Exhibition buildings was struck by lightning on the night of August 19th and burnt to the ground; but although it contained a number of small items of electrical interest, the main electrical exhibits were not damaged at all.

The exhibition is well worth a visit, especially as the cost of accommodation is very reasonable, and the train service from Paris is convenient.

The Super-Heterodyne Radio Receiver.

A Simple Explanation of the Principles Involved.

By R. ROBERT.

A good deal of attention is being paid at the moment to the methods of securing critical tuning in wireless receivers. With the large number of stations sending out interesting programmes, the broadcatcher has developed a very decided *flair* for distance. He desires at times to cut out his local station and to hear, reasonably free from interference, say, Madrid or Brussels. This has led, naturally, to the evolution of receivers combining range with ultra-selectivity, one of the most popular of such receivers at the present moment being the supersonic-heterodyne.

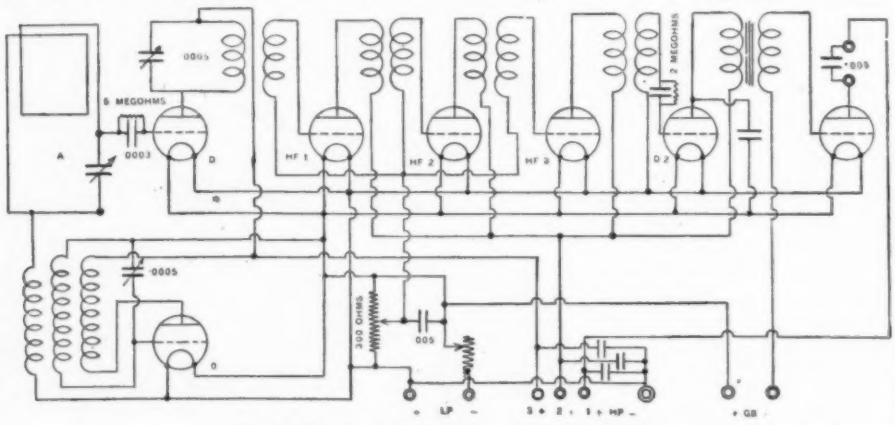


Fig. 1.—Diagram Illustrating Super-heterodyne Prin.iple.

The Heterodyne Principle.—The principle of this exceedingly effective receiver may be roughly gathered from the diagram reproduced in fig. 1. There is, first, the frame aerial—used on account of the extra selectivity obtainable—shunted by the condenser A. The h.f. oscillations generated in this circuit may be amplified, if desired, by one or two h.f. valves before being passed on to the detector valve D. Superimposed upon the oscillations due to the incoming signal, there are the local oscillations generated by the oscillator valve O; the frequency of these oscillations is so arranged, by the insertion of suitable values of capacity and inductance, that it is either slightly higher or lower than the frequency of the incoming signal, the result being that a "beat" frequency is set up. To take a concrete example: The incoming signal might have a frequency of 1,000,000 cycles per second (corresponding to 300 metres); the local oscillations might be set at 1,060,000 cycles per sec., in which case the "beat" note would have a frequency equal to the difference, *i.e.*, 60,000

cycles per second. This beat signal (60,000 cycles corresponds to a wavelength of 5,000 metres) is now rectified and amplified by the three h.f. valves, HF_1, HF_2, and HF_3. The signal is rectified a second time at D_2, whence it may be passed finally through one or two stages of audio frequency amplification.

Advantages.—The advantage of this arrangement lies in the fact that by "converting" the wavelength of the incoming signal from 300 to 5,000 metres it is more readily amplified (multi-stage h.f. amplification on the short waves is, of course, notoriously difficult). Moreover, a slight change in the frequency of either oscillator or incoming signal will make an enormous difference to the wavelength of the "beat." If, for instance, the wavelength of the incoming signal were increased from 300-305 metres, we should get:

305 metres $= 3 \times 10^8/305 = 983{,}606$ cycles per second.
Heterodyne = 1,060,000 cycles; "beat" frequency = 76,394 cycles.
λ of "beat" $= 3 \times 10^8/76{,}394 = 3{,}926$ metres.

Therefore, the difference created by 5 metres change in the incoming wave = *1,074 metres*! This will, of course, largely explain the super-het.'s quite phenomenal selectivity!

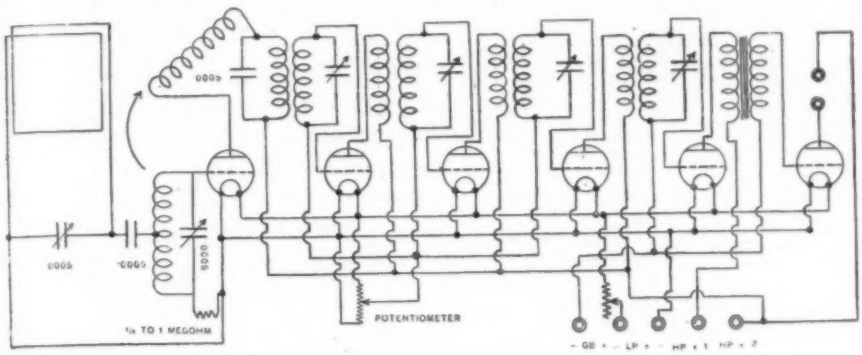


Fig. 2.—Arrangement of Tropodyne Circuit.

Essential Components.—In the case of a super-heterodyne receiver, particular care has to be exercised in the choice of components. The most important items will be the intermediate h.f. transformers and the tuning condensers; the latter should be of the "low loss" pattern, and geared dials are an absolute essential. Matched h.f. transformers suitable for the "super-het." are now freely available on the market, amongst the most efficient, so far as the present writer's experience goes, being an American pattern, the main features of which are the laminated iron cores and the small mica variable condensers by means of which the secondary windings may be tuned; the design, it is claimed, results in high amplification being obtained without in any way affecting selectivity. The oscillator coupler is another essential unit, and several excellent components—of both British and American designs—are now on the market. As it is usual to operate the "super-het." on dull-emitter valves, suitable rheostats must be chosen, though, generally speaking, one rheostat may be made to control the whole of the valves, thus making for simplicity. Finally, in order to ensure freedom from microphonic noises, the valve-holders should preferably be of the anti-phonic" pattern.

The Tropodyne Receiver.—A super-heterodyne set that is particularly interesting on account of the comparatively small number of valves required, is the "Tropodyne." Six valves are used, as against the more customary eight or nine, the arrangement of the circuit being shown in fig. 2. From this it will be seen that all h.f. valves ahead of the first detector have been eliminated; furthermore, by a slight modification of the circuit the first valve is made to act in the dual capacity of detector and local oscillator. The rest of the circuit is straightforward enough—three stages of intermediate h.f. amplification are employed, followed by a second detector and a l.f. stage. A noteworthy feature, however, is the omission of the customary grid leak and condenser for the second detector valve. Rectification is brought about by operating on the bends of the characteristic curve, and a grid bias terminal is provided on the panel for this purpose. It is now possible to obtain complete kits for building up the "tropodyne" receiver quite readily, the kits comprising a suitable oscillator coupler and four intermediate transformers of the type already referred to.

Manipulation.—The ease with which the "super-het." may be operated is the last, though by no means the least, of its many advantages. On a straightforward set there are usually only four controls, *i.e.*, for the filaments, (2) aerial tuning, (3) potentiometer (stabilising the intermediate h.f. amplifier), and (4) oscillator condenser. The procedure of tuning-in is somewhat as follows:—The frame is first rotated so as to be approximately directional for the transmitting station; the oscillator condenser is then moved one or two degrees at a time, each adjustment of this condenser being followed by a complete swing of the aerial-tuning condenser. The long-wave amplifier should be kept just below the oscillating point, a condition which may be brought about by suitable adjustment of the potentiometer. The station will be found to come in at two points on the oscillator condenser, and it is usual to work in that position, which gives greatest freedom from interfering signals. The adjustment of the condensers will be found to be extremely critical, a degree or two either way being usually sufficient to lose the signal. When certain types of transformers with tuned secondary windings are used, they should be carefully tuned to a particular wavelength—say, 5,000 metres—after which they do not require any further attention or adjustment.

Legal.

Colwyn Bay U.D.C. v. Llandudno and Colwyn Bay Electric Railway, Ltd.

IN the Vacation Court on August 26th, Mr. Justice Finlay had again before him the motion by the Colwyn Bay Urban District Council to restrain the defendants until the trial of the action from running tramcars on Sundays in alleged breach of agreement (*vide* our last issue, p. 333).

Mr. G. B. HURST, K.C., for the defendants, contended that the agreement in question was superseded by a Provisional Order of September 30th, 1907, which gave the Council power to regulate the running of the cars by the making of by-laws which would have to be sanctioned by the Board of Trade, before whom the public would have the right to oppose them. He also submitted that the Light Railways Act, 1896, imposed a statutory obligation upon the company to construct, maintain and run the cars which was incompatible with an agreement made with the Council behind the backs of the public. The public had to be considered as well as the Council and the company, and the agreement was against public policy.

Mr. E. W. CAVE, K.C., for the Council, said that the general public were not affected, as the cars were only run for the benefit of the members of a golf club.

Mr. JUSTICE FINLAY said that it was not without some hesitation that he thought he ought to make an order in this case, but in his opinion the object of the agreement was to avoid the necessity of the Council's having to make by-laws preventing the running of the tramcars. He granted the interim injunction asked for.

Hotel Without Bells.—House telephones, which can also be used for outside calls, will take the place of the old-fashioned push bell in the new hotel which is being erected on the steel skeleton which has stood for ten years in Piccadilly. Arrangements have been made for the installation of four hundred telephones. The occupant of any room will be able to call up, on one instrument, any department in the hotel, or any number in the directory; he will be able to talk to his next room neighbour, or to the North of Scotland. Inside calls, of course, will not be charged for.

D

Electricity in Agriculture.

Abstract of I.E.E. Committee's Report.*

THE Committee appointed by the Institution of Electrical Engineers in March, 1923, to consider the use of electricity in agriculture held five meetings, and has summarised the information it obtained in the form of a report under the following headings :—

Uses of Electricity.

Lighting.—Electric light is of considerable assistance to the farmer, and its use permits certain operations which at present are carried out in daylight only to be performed by artificial light. The risk of fire, always serious on the farm, is minimised.

Motive Power.—Electric motors are generally stationary, either attached to the machines they operate, such as chaff-cutting and corn-grinding machinery, or driving by means of shafting a group of machines, as in dairies. Special types of portable motors suited to farm work have been evolved, particularly on the Continent, fitted with suitable reduction gearing for the operation of portable and stationary machines which run too intermittently to justify separate motors. Table 1 may be taken to be a reasonable estimate of use for an average farm, and Table 2 sets out the ascertained figures of use on 33 British farms in a certain supply area.

TABLE 1.

Consumption on a Farm of 150 Acres.

	kWh per annum.
Lighting (house)	100
Lighting (buildings)	150
Motive power, barn and dairy	1,500
Heating and cooking	1,500
	3,250

TABLE 2.

Annual use on Farms in Great Britain.

Motors on each farm, average	1.4	
Average horse-power	10	
Electric lamps per farm house	18	
Electric lamps in buildings	18	
Average consumption per annum—		
Lighting	370	kWh
Heating	470	,,
Power	1,370	,,
Average total consumption per annum ...	2,210	,,
Average acreage	230	,,
Average consumption per acre per annum ...	9.5	,,

Statistics of use on Continental farms which have used electricity for several years show a higher consumption than this, averaging 22 kWh per acre. The consumption of electricity per acre of arable land is apparently a function of the fertility of the soil. In a very fertile region in the North-East of Germany the consumption averages (without any electric ploughing) 100 kWh per acre. In accordance with the returns for 34 rural districts in Germany, the consumption per acre was 12.5 to 22.5 kWh for lighting and 27.5 to 42 kWh for power, a total of 40 to 65.5, or an average of 50 kWh per acre.

In the Field.—The principal potential use of electric motors is for ploughing, harrowing, &c., and for thrashing. The application of electricity to ploughing requires motors of from 12 to 125 h.p., and is carried out in one of several ways, those most generally adopted being :—

(i) By means of two stationary motors placed one at each side of the field to be ploughed, with a single steel cable traversing the distance between them, the plough being hauled in one direction by one motor and in the other direction by the other motor.

(ii) By the Howard or Fisken system, which uses a single fixed motor and, by means of ropes with movable anchored pulleys, draws the plough or other implement backwards and forwards on the field.

In general these systems, as in the case of steam-ploughing on the well-known Fowler system, are applicable to large farms, or suitable for employment by contractors who carry out the work on terms for the individual farmer. The problem of electric ploughing, although it is one of the most important on the farm, particularly in view of the growing importance of the sugar-beet industry, which requires deep ploughing, cannot be said to be fully solved. It would be the most important load on the farm from the point of view of the power supply engineer. All the arable land on a farm might well be ploughed twice a year, with a consumption of at least 20 kWh per acre, that is, 40 kWh per acre per year. Cultivation work on similar lines would take about half this amount say, 20 kWh per acre, or a total of 60 kWh per acre; that is, on a farm of 150 acres, half arable, 4,500 kWh for the field operations alone. In the absence of any extended experience of electric ploughing in this country comparative costs are not available.

Cost of Electric Ploughing.

The following (Table 3) prices at which electric ploughing is done in France by contract represent cost and profit, the price being regulated by competition with horse ploughing. The figures are given subject to a caution that comparison between the British and French figures must not be taken too literally, as the external and internal values of the franc are very different :—

TABLE 3.

Contractors' Price List.

Depth of Ploughing.	Subsoiling.	Total depth.	Price per acre.	
in.	in.	in.	fr.	s. d.†
10—12	5—6	15—18	137	34 3
8—10	5—6	13—16	130	32 6
12—14	—	12—14	127	32
10—12	—	10—12	120	30
6—8	5—6	11—14	120	30
8—10	—	8—10	93	23
6—8	—	6—8	66	16 6

† At 80 fr. to the £.

The charge for scuffling to a depth of about 4 in. was 40 fr. (say, 10s.) per acre. In France it is usually reckoned that 10 fr. (say, 2s. 6d.) per 4 in. of depth is a reasonable charge to pay to contractors for ploughing and subsoiling. In the 1924 season an electric ploughing set ploughed 1,453 acres (588 hectares); scuffling was done at the rate of 49½ acres (20 hectares) per day, while a six-furrow plough accomplished from 16¾ to 19¾ acres (6 to 8 hectares) in the same time, and a four-furrow deep plough did 12½ acres (5 hectares).

Thrashing by means of portable electric motors is another operation which is frequently done on the Continent through contracting firms, which supply a portable transformer for connecting to the distribution system, a cable drum, and the necessary large portable motor.

Crop Stimulation.

A good deal of isolated and badly co-ordinated experimental work has been done by various observers as to the stimulation of field crops, from which a general impression only can be received; it would appear, however, to be established that it is possible in certain cases to increase considerably the quantity and quality of certain crops. In 1918 a committee was formed by the Government, under Sir John Snell, to investigate this question, and seven reports‡ have been prepared. The results of the field experiments were so conflicting and difficult to reconcile that it has been decided at present to concentrate on pot-culture experiments, with a view to determining as quickly as possible the general conditions of electrification which are favourable, after which field operations will be resumed.

It has been stated in the second report of the Committee referred to, that increase in yield averaging about 30 per cent. has been obtained in field experiments. The matter has reached a stage which is as yet of no very great practical importance, or direct application, owing to lack of commercial data and apparatus suitable for placing in the hands of the farmer. The amount of electricity used for the purpose is insignificant, not amounting to more than about 10 watts per acre, applied for, say, 2 hours a day for one to two months of the growing period.

Capital Outlay.

At the Farm.—Generally, it is probable that as regards the larger field operations the capital outlay is so considerable relative to the amount of use on any particular farm, that except in the case of the largest farms the ploughing and cultivating tackle, as has occurred in the case of steam tackle, will be owned by contractors who will do the work for the farmer. On the other hand, the use of electricity in the house, barn, and dairy will be made with machinery and appliances provided by the farmer, and the cost may be estimated as follows :—

	£
Three electric motors, aggregating 10 h.p., with starting and reducing gear	60
Electric light, 36 points in house and building ...	36
Sundry cable and switchgear, not included in the lighting	20
	116
Sundry household apparatus	40
	£156

There is evidence that farmers will willingly pay for lighting 8d. per kWh, for heat 2d., and for power 4d. (electric ploughing from 1d. to 2d.). It is difficult to put any precise figure on the financial return to the farmer. It is probable that on farms employing five men and upwards where other power has not been installed, at least one man can be saved. On smaller farms the advantage would be rather in reducing the number of hours the farmer and his family would have to

* From the *Journal* of the Institution of Electrical Engineers, August, 1925.

‡ Copies may be obtained from the Ministry of Agriculture.

work and reducing the actual manual toil involved, reducing risks of fire, or increasing the output of the farm. There is no doubt also that the provision of good lighting in the mornings and evenings of the winter months contributes to saving of waste of materials and of time lost. In the case of farmers owning a considerable head of poultry, it has been established that by lighting the poultry houses in the winter months morning and evening there is an improvement in the average value of the eggs produced, not so much in an increased total number as in their distribution towards the months when daylight is shortest, with a consequent advantage of about 20 per cent. in their average value. The result of these various factors is that in the case of an ordinary farm it is estimated by the Committee that these outlays will repay themselves in about four years, after which there will be a return, allowing for repairs, of probably 20 per cent. per annum on the money spent on the equipment. Although this is attractive, the fact has to be faced that farmers have lost a large amount of their capital during the last few years, and that it is probable that in the majority of cases some system of furnishing the equipment on hire-purchase terms would be necessary to encourage the adoption of electricity.

On Distribution.—In this question lies the principal problem of the supply of electricity for agricultural purposes. Whatever the future may hold, there is universal agreement that, in the early stages of establishing a network of mains to supply purely agricultural areas with electric power, there will not be a load which will produce a fair return on the expenditure for distributing mains if the development of the uses of electricity is left almost entirely to the initiative of the farmers. The experience in England, France, Italy, Switzerland, Holland, Sweden, and Canada leads to the same conclusion and to the general statement that (1) there must exist other sources of income for the transmission system capable of carrying a large, if not the major, part of the capital charges on the investment during the period required for the natural education of the farmers; or (2) there must be an abnormal economic demand for the energy, rendering possible its sale at an abnormal price; or (3) there must exist an abnormal supply of electrical energy which could not otherwise be sold, rendering economic its sale at a price well below the average cost of production, or (4) there must exist social or political reasons why the supply should be furnished at an uneconomic price on account of other advantages to be gained.

In the first category is Sweden, where the transmission lines from the waterfalls pass along the valleys in which the agricultural areas are situated, and the lines are easily tapped. In Holland lines are put up for distribution to towns and for the driving of drainage pumps throughout the country, which lines are again easily tapped for agricultural purposes. Or, again, in Switzerland, a large number of small towns in which are situated semi-domestic industries are bear[ing] [cos]ts of the transmission and distribution networks used for agricultural purposes.

In the second category is France, where the shortage of man power stresses the necessity for the supply of motive power, and, in addition, the necessity of maintaining a source of military strength necessitates the maintaining of the agricultural areas at their highest working power and making them as attractive as possible to the population, even at the expense of the State.

The third case is illustrated by Italy, where there is a superabundance of hydraulic power from the Alps in the summer time, the season of the year when the industrial demand is at its lowest and the farming demand at its maximum.

In this country it is probable that the first-mentioned consideration will be the predominating influence, though it is likely that the existence of loads other than those provided by agricultural operations or, alternatively, the establishment of industries providing such loads, will be dominant factors so far as rural electricity supply is concerned. Also, in other countries, notably in Scandinavia, Canada and Italy, financial assistance is given by the State towards the provision of rural distribution lines.

Schemes in Operation.

In some parts of the Continent the supply of electricity is remunerative. When the electrical equipment of railways becomes an accomplished fact there will be a general distribution system in existence which will enable electricity to be carried more widely into the agricultural areas. The towns of Altrincham, Aylesbury, Chester, Hereford, Wolverhampton, &c., have already extended, or decided to extend, their lines into the surrounding districts, while the power supply undertakings in South Wales, Fife, Kilmarnock, &c., are already supplying a number of farmers. With regard to the actual cost of such distributions, for 6,600-volt overhead bare lines on insulators with creosoted poles carrying three conductors, each No. 10 S.W.G., all to comply with the Electricity Commissioners' regulations, the cost would lie between £500 and £600 per mile, and it is probable that cheap underground cable systems could be laid in the open country for about the same figure, but the fact remains that the lines erected in agricultural districts in foreign countries have cost much less—even as low as £100 per mile in Sweden—and it is probable that a study of the best methods of erecting such lines will lead to a figure of £250 to £500 per mile to comply with the regulations necessary in this country. There is little doubt that the single-phase system is cheaper and there is more simplification in transforming and switching gear. On the other hand, the motors are rather larger and more costly, and, so far, whatever installations have been completed have been upon the three-phase system.

In order to summarise this part of the report, it may be well to give the following actual example (in Sweden) obtained by a member of the Committee where conditions were not favourable to a large consumption per acre, as the land was poor. In a rural area of 3,700 acres (of which 1,700 were woodland and waste) about 15 miles of distributors were used to supply 22 farms and 29 other rural customers whose consumption, averaged over several years, was 82,000 kWh per annum. The return on the capital expended (which was heavy, as the work was carried out during the war) was 5 per cent. per annum. The consumption per acre was 22 kWh, or 5,570 kWh per mile of distributor.

Steps Which Might be Taken by the Institution.

Although the actual consumption per acre or per farm appears small, yet the total acreage of farm lands in this country is nearly 27 millions out of the total area of 56,788,366 acres in England, Scotland, and Wales, and the supply of electricity to farms, if carried out, would aggregate a very large total, say, under English conditions, 200 million kWh per annum without electric ploughing or cultivation, and from two to three times this amount if electric ploughing and cultivation as in Continental practice were adopted. The laying out of the work, the construction of the generating plant and cables or overhead lines, and the supply of plant and accessories would form a very important addition to the activities of the electrical industry. This, added to the social and economic betterment arising therefrom, is of such importance that it is recommended that the Institution should use its influence in promoting this object. To this end the following are some of the steps that might be taken:—

(1) The appointment of a permanent Committee, to advise the Council of any development arising which it should take note of, or on which it should take action.

(2) The presentation of a memorandum to the Government pointing out the advantages that would arise from a wide distribution of electricity to agricultural counties, and that this should be taken into consideration in fostering schemes of railway electrification.

(3) That a special recommendation should be made to the Government in connection with the provision of financial assistance, either in the form of direct grants or the provision of finance at specially low rates and repayable over long periods, towards the cost of provision of distribution lines in rural areas in districts where there is a prospect of the undertaking becoming profitable in the course of a few years.

(4) That the Institution should take steps to encourage the design by the leading British manufacturing firms of electrical apparatus especially suited to agricultural conditions.

(5) That in connection therewith the Government should be urged to issue through the Ministry of Agriculture in conjunction with the Electricity Commissioners authoritative leaflets on the subject, showing what has been done and what can and ought to be done by farmers when a supply is available.

(6) That the Institution should offer to co-operate with the Royal Agricultural Society and other agricultural bodies in tests and experimental work, and in formulating a policy for the supply of electricity to the farming population.

(7) That the Institution should take steps to obtain a paper each year on a subject dealing with the applications of electricity to agriculture, and that joint meetings with the Royal Agricultural Society or with one of the other farmers' organisations should be arranged.

(8) That the Institution should take steps to initiate experimental work by, or through, existing bodies:—(*a*) In improving the efficiency of farm implements and machines by redesign to use the new forms of power available. (*b*) In improving the efficiency of methods of crop treatment by means of the new form of power available. (*c*) In carrying out investigations that would provide useful data in relation to the application of electricity to agriculture.

(9) That the Institution should take steps to propose rules for rural distribution networks, overhead and underground, these rules only to apply to distribution to farms, villages, and small industries, leaving other work to be carried out under the existing regulations as at present approved by the Electricity Commissioners.

J.I.E. Library Catalogue.—We have received from the Junior Institution of Engineers a copy of the catalogue of books in the Institution Library, which has been recently compiled and is, we understand, being sent free to all members of the Institution with the September issue of the *Journal*. The material is classified so as to enable one to see at a glance what books on any particular branch of engineering the Institution possesses. The fact that the Institution embraces all branches of engineering naturally means a non-specialised Library; the rapid increase in recent years of the number of books in its possession made it imperative that a comprehensive list should be issued, and much consideration was given to the method in which the books should be catalogued. The blank spaces left at the end of each section are a special feature, designed for the inclusion of new works as these are added to the Library; particulars will be printed on gummed paper and issued quarterly to the members, who will thus be able to maintain their lists up to date.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

On Finding the Right Man and Keeping Him.

I have read with interest the article by Mr. W. Roland Needham in your issue of August 21st, and agree that employers are apt to employ men who have "notable credentials," a bouncing manner, and on paper, "a man who can reel off a most formidable itinerary of service," but who "in fact is a most ignorant person." I myself have had experience of such; one will come in contact with men at work who are absolutely incompetent for the positions they hold. Why? because nine times out of ten, the men under them do the work and these incompetent "officials" get the credit and therefore hold their "jobs." My idea is this: If you have a man who is trustworthy, keen, and intelligent, look after him and encourage him and one day you can offer him that vacant senior position. Grow a man for the job. I know of one works manager who will not employ new labour if he can possibly avoid it, but grows all his men for the vacant responsible positions and he always gets satisfaction. I noticed an advertisement in a technical journal lately to this effect: "Advertiser seeks position, age 24," then a long list of experience in almost every branch of the electrical trade and outside the electrical trade; common sense should tell that no man of 23 has had such experience. To conclude, let the managers, assistant managers, and engineers keep their eyes open amongst the men, and select those to whom they can safely offer senior positions and not go by what they are told, or because "his father or relation is a friend of mine."

Mr. Nervous Man.

Pontypridd, *August 27th*, 1925.

Is There an Age Limit?

The letters on the above subject are really amusing to me, as a unit of the despised working class.

It does not seem credible that persons who have held important positions under the employers as stated are ignorant of the existence of the age limit as a definite law which the workman is confronted with, as of necessity they must have enforced it as efficient servants of Capital.

Your correspondents, if they take the trouble to inquire, will find that all transport concerns, Government departments, and all large establishments, have the age limit strictly enforced with the solitary exception of the judicial profession, where you could be employed till you were 150. At the present time in the electrical industry the employable age would appear to be from 14 to 30, and after that oblivion.

Thanks to the patriotic efforts of our rulers in enforcing payment of our debts to the profiteers who bled the British people when they were fighting for existence and who are now cowardly to exact payment from their own debtors, the nation is now bankrupt. Of course this statement will be challenged, but the facts remain: A nation's wealth lies in its skilled workmen, and England's have departed or are rotting in the streets.

It appears that in the near future electrical work will be erected with the aid of the paste pot, and the efficiency of the workman will be graded on the merits of his application thereof.

Trades are now recognised as a blind alley, not a living wage when one is out of work four months in the year, and it is a crime to apprentice boys to them. It was stated, I believe, by the man who won the war—the Minister of Munitions—that it was an engineers' war. The only thing to be said is: May the Saints help England in the next, when there are no skilled craftsmen left.

With reference to Major Porter's letter, I would point out that a criminal receives better treatment than an ex-Serviceman.

Ex-Sapper, Royal Engineers.

August 18th, 1925.

Charges for Electricity Supply.

With reference to the issue of the ELECTRICAL REVIEW dated August 28th, 1925, my attention has been drawn to the statement on page 346 dealing with "Charges for Electricity Supply."

I note that your correspondent includes Eccles in a list of undertakings which do not hire-out electric cookers. This statement is not correct, as the Eccles electricity undertaking has had in operation a hiring scheme for electric cookers for over 12 months. The rental charged for the hire of the cooker is at the rate of 7s. 6d. per quarter, and the rate of charge for a supply of electrical energy for cooking purposes is 1d. per unit, plus 12½ per cent., less 5 per cent.

I shall be obliged if you will kindly publish this correction so as to remove the mistaken impression arising from the statement in last week's ELECTRICAL REVIEW.

H. W. Angus,
Borough Electrical Engineer.

Eccles Corporation Electricity Works, *August 31st*, 1925.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Electricity in North Wales.—Speaking at a luncheon last week attended by members of the Conway and Colwyn Bay Joint Water Board, Mr. H. J. Jack, managing director of the Aluminium Power Corporation, intimated that an electricity distribution company with a capital of £250,000 would shortly be formed to light with electricity North Wales towns at present without a supply.

Coal Meter Orders.—THE LEA RECORDER CO., LTD., has recently received orders for its coal meter from the following electricity supply undertakings, &c.: Barking (24), Liverpool (14), Nottingham (18), Preston (15), Salford (18), Stoke-on-Trent (19), Devonport Dockyard (26), Colenso (Natal) (16), Hong Kong Electric Co. (16), Calcutta Electric Supply Corporation (15), and Copenhagen (4).

Brazil's Wire and Cable Imports.—Statistics published in *Commerce Reports* show that during 1923 Brazil imported 890 metric tons of uninsulated copper wire, 957 tons of insulated copper wire and 1,332 tons of electric cables. The bulk of the total came from the United States, although Great Britain was the principal supplier of electric cables.

Lead Market Report.—Messrs. James Forster & Co., reporting on August 29th, stated:—"Official closing prices yesterday were £39 for August and £36 16s. 3d. for November, showing a fall on the week of 5s. a ton for forward, with August unchanged. The firm tone which set in at the end of last week was continued, and prices by Wednesday had advanced a further 17s. 6d. for August and 11s. 3d. for November, until £39 17s. 6d. and £37 12s. 6d. respectively were touched. On Thursday and Friday there was a reaction of about 16s. 3d. a ton in all positions. The close is steady at £39 2s. 6d. for August, £38 8s. 9d. for September, £37 10s. for October, and £36 16s. 3d. for November. Consumers, particularly cable-makers, have bought heavily this week for September and October delivery. Arrivals this month should total well over 20,000 tons, but in spite of this prompt lead is scarce, the premium over forward now standing at 45s. a ton. The question of future supplies is complicated by the constant friction in the shipping trade in Australia, where steamers are being delayed and lead is accumulating at the ports."

Hungarian Electrical Exports.—According to the *Board of Trade Journal* the exports of electrical machinery and apparatus during the first six months of the current year amounted to 14,932 quintals valued at 5,742,000 kr. (gold). This compares with 18,600 quintals (7,891,000 kr.) in the first half of 192

Boiler Contracts.—Messrs. Yarrow & Co. (1922), Ltd., inform us that they have recently secured an order for four of their patent water-tube boilers, with Yarrow superheaters and air heaters, for an important power station in London, each boiler having a maximum output of about 100,000 lb. of steam. They state that this is the third important electric power station in London which has recently introduced their boilers, the others being the County of London Electric Supply Co.'s power station at Barking and the London Electric Supply Corporation's station at Deptford.

Trade Announcements.—Mr. S. CROSBY, radio engineer, has opened premises at 8, Walton Road, Stockton Heath, near Warrington.

The NATIONAL GAS ENGINE CO., LTD., has removed to its new offices at Australia House, Strand, W.C.2, as from September 1st. The telephone numbers will remain the same as before, *viz.*, "Central 7084 and 7085."

Mr. HAROLD FIELD, A.M.I.E.E., for the last 10 years engaged as works manager and lately as general manager to the Western Engineering Co., Swansea, has now purchased the whole of the works and premises of that company, and intends to carry on business on his own account at that address. He asks for catalogues of electrical and mechanical plant.

THE Z ELECTRIC LAMP & SUPPLIES CO., LTD., has appointed Mr. D. J. Crawford as its Nottingham and district representative in the place of Mr. Thorburn, who has left the company. Mr. R. P. Stewart, 30, Commercial Street, Dundee, has been appointed Dundee and district agent.

MESSRS. MORLEY & THUEY have opened premises at 21a, Hill Rise, Richmond, Surrey, for the sale of electrical and radio apparatus, and ask for catalogues.

MESSRS. F. WINKWORTH & Co., electrical engineers, have removed from 137, Victoria Street to 82, Victoria Street, S.W.1. Their new telephone numbers are Victoria 1770 and 1771.

Catalogues and Lists.—METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 783/2-1, containing illustrated particulars of applications of arc welding.

THE EVER READY CO. (GREAT BRITAIN), LTD., Hercules Place, Holloway, N.7.—General catalogue for 1925-26 of dry batteries for radio and general applications; Leclanché cells; pocket lamps and small lighting sets; and accumulators.

THE MULLARD RADIO VALVE CO., LTD., Nightingale Lane, Balham, S.W.12.—An illustrated pamphlet describing the company's publicity scheme for the coming radio season.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for August, dealing with correct illumination, &c. Also an illustrated pamphlet dealing with the "Rodalux" longitudinal street lighting reflector.

MR. ALAN WRIGHT, Sentinel House, Southampton Row, W.C.1.—A folder containing illustrations of "Inventum" toasters, irons, bowl fires, kettles, and other appliances. Priced.

THE LISENIN WIRELESS COMPANY, Connaught House, 1a, Edgware Road, W.2.—An illustrated and priced trade catalogue of radio components and accessories.

MR. GEORGE ELLISON, Perry Barr, Birmingham.—An illustrated booklet, entitled "Starting and Stopping Electric Motors," and containing particulars of the firm's controllers in non-technical language.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—An illustrated folder, giving details of an "Exide" publicity "campaign" which is being carried out by the company, together with specimens of showcards, posters, &c., which are being issued in connection with it.

CLEARTRON RADIO, LTD., 1, Charing Cross, W.C.—A price list of "Cleartron" radio valves for various applications.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card advertising "Cambridge" automatic temperature regulators.

MESSRS. HENRY POOLEY & SON, LTD., John Bright Street, Birmingham.—Catalogue No. 1,825, dealing with counter scales and scale beams.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 104, containing illustrated particulars of overhead hand-power cranes.

ELECTRO-DYNAMIC CONSTRUCTION CO., LTD., Malt Street, S.E.1.—A price list of variable-speed polyphase commutator shunt motors.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—A priced folder and an illustrated leaflet advertising "Elasta" electric lamps.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—An illustrated pamphlet dealing with a number of street-lighting fittings and appliances which are to be shown at the forthcoming conference of the Institution of Public Lighting Engineers.

JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—Two illustrated and priced leaflets dealing with water-heating apparatus; also a blotter for September.

MESSRS. WOOTTON & CO., LTD., High Street, Ponder's End, Middlesex.—A catalogue of wood fittings for electrical purposes. Illustrated and priced.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—An illustrated price sheet of "Universal" domestic appliances, including fans, vacuum cleaners, irons, cookers, &c.; and "Silverlite" shop-window reflectors.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—A well-illustrated price list of radio receiving sets, components, and accessories.

THE ELECTRIC STREET LIGHTING APPARATUS CO., 6, High Street, Canterbury.—A catalogue containing illustrations, details, and polar curves of a number of street-lighting fittings.

THE LEA RECORDER CO., LTD., 28, Deansgate, Manchester.—Two pamphlets, containing the names and opinions of users of "Lea" coal meters.

Bankruptcy Proceedings.—H. WILSON, electrical contractor and decorator, 1057, Grangefield Avenue, Thornbury, Bradford.—Receiving order made August 21st on debtor's own petition. First meeting, September 7th, at the Official Receiver's office, 12, Duke Street, Bradford; public examination, October 5th, at the County Court, Bradford.

M. O. HUGHES, electrical wholesaler and agent, 643, Welbeck Road and Star Buildings, Northumberland Street, Newcastle-on-Tyne.—Trustee, Mr. W. Brittain, 4, Northumberland Street, Newcastle-on-Tyne, released July 13th.

C. BINNS (United Electric Co.), electrical engineer, 55, Low Briggate, Shipley, Yorks.—First and final dividend of 1s. 0¾d. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

W. DUNCAN, electrician, New Road, Dunblane.—Meeting of creditors was called for September 3rd, at County Buikings, Dunblane. Mr. C. H. Urmston, agent, 140, Princes Street, Edinburgh.

F. J. TIZZARD and N. TIZZARD (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 121, Market Street, Dalton-in-Furness.—Receiving order made August 26th, on debtors' own petition.

S. G. WILKINSON, electrician, 25, Havelock Road, Harrow, and 16, High Road, Wembley. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released July 23rd.

J. HILLIER, electrical engineer, 58, Trafalgar Terrace, Swansea.—Trustee, Mr. H. Rees, Official Receiver, Government Buildings, St. Mary Street, Swansea, released July 17th.

Company Liquidations.—E. S. COMPANY, LIMITED, electrical and wireless dealers, 233, Tottenham Court Road, London, W. The following are creditors, in addition to those mentioned in our issue of August 14th (p. 257):—

	£		£
Aldous Campbell, Ltd.	22	Jungbaur, W.	33
Atlas Carbon & Battery Co. ...	48	Jardine, John	47
Allgood, G. & S.	22	London Commercial Electric Co.	32
Belling & Co.	60	Leach, S. G., & Co., Ltd. ...	91
Berry's Electric, Ltd.	94	Lowenadler, F. H.	71
Bint & Co.	22	London Electric Wire Co. and Smiths, Ltd.	39
British B.A.G., Ltd.	87	Milner, F.	39
Burndept, Ltd.	50	Morris, J. R.	26
Bateman & Co.	55	Middlesbrough Steel Tube Co....	43
Cooke & Vowles	29	Marshall Electric Co.	32
Cables & Electric Supplies Co....	55	Manchester Radio Co.	48
Criscuolo, Ltd.	32	Northern Radio Co.	37
Central Cable & Accessories Co.	23	Preh, J., Junr.	41
De Garrs & Allen, Ltd.	23	Riuso, J.	43
De Maid, Ltd.	53	Radio Communication Co., Ltd.	55
Dubilier Condenser Co.	21	Radiobats, Ltd.	140
Electric Accessories Manufacturing Co.	32	Siemens Bros. & Co.	53
Ebonestos Insulators, Ltd. ...	54	Simplex Conduits, Ltd.	36
Evans, Stanley	32	Sanders, W.	65
Electric Heating & Hardware Co.	64	Scupham & Wood, Ltd.	68
Ever-Ready Co.	55	Shanks, D., & Co.	25
Engineering Supplies	23	Sullivan, H. W., Ltd.	60
British L. M. Ericsson Mfg. Co., Ltd.	76	Saveker, T.	34
European & General	34	Supra Electric Co.	48
Ehrmann, R.	56	Schaffer Bros. & Berry	53
Ego Engineering Co.	45	Sterling Accessories, Ltd. ...	66
Falk, Stadelmann & Co.	68	Southgate, Ltd.	64
Forward Electric Co.	25	Shrimpton & Sons	69
Fuller's United Electric Works...	81	Sperryn & Co.	51
Formo Co.	35	Street, G., & Co.	66
Grant, R. C., & Co.	21	Stonham & Sons	25
General Radio Co.	40	Siebs, P., & Co.	30
Gothe & Sohne	58	Swiss Insulating Co.	30
Garnett, Whiteley & Co., Ltd....	44	Schmahl & Schultz	46
Helophane, Ltd.	33	Srangrant Bros., Ltd.	43
Horstmann Gear Co., Ltd. ...	27	Smithers, Ltd.	27
W. T. Henley's Telegraph Works Co., Ltd.	25	Thursfield & Co.	68
Johnsen & Jorgensen	51	Vincent Switchgear Mfg. Co. ...	50
		Vandervell & Co., Ltd.	22
		White, J. C.	31
		Wholesale Fittings Co.	68

ROBINS WHOLESALE ELECTRICAL & WIRELESS CO., LTD., Fanny Street, Cardiff.—A meeting of the creditors of the above was held recently at the offices of Messrs. Clarke, Dovey & Co., Cardiff. A statement of affairs was presented, which disclosed liabilities of £4,261, including £3,372 due to trade creditors. In addition, there were fully secured creditors for £11, who held security valued at a like amount. There were debentures for £2,148, with interest accrued amounting to £74. The net assets amounted to £595, leaving a deficiency as regarded the creditors of £3,036. The issued share capital amounted to £999, making the total deficiency £4,665. The company was incorporated on August 7th, 1922, as the Robins Electric & Wireless Depository & Institute, Ltd., for the purpose of dealing in radio requisites, both wholesale and retail. The nominal capital of the company was £1,000. For the purpose of obtaining wholesale terms from members of the N.A.R.M., a separate company was registered in September, 1924, under the name of Robins, Ltd., and the name of the original company was changed to the present title, the intention being to deal in a wholesale way only. The whole of the purchases of Robins, Ltd., had been made from the present company, and the latter had also purchased goods for another small company which was formed in February of this year. The deficiency was attributed to depreciation written off the assets, and loss on trading. At the present time there was a sum of £1,316 due from the retail company for goods supplied. Mr. Robins, who was the debenture holder in respect of cash advanced and machinery, plant and stock, stated that he was willing to take over that debt and credit it against his debenture. A fire took place in October, 1923, and £1,800 was received from the insurance company. In consequence of the company being pressed by creditors, the debenture holder, on April 17th, appointed a receiver, who was now in possession of the assets, and the sum of £300 had been paid off the debenture by the receiver to Mr. Robins. It was decided that a petition should be presented for the compulsory winding-up of the company. The following are creditors:—

	£		£
Acme Productions Co., Ltd. ...	50	Marconiphone Co., Ltd.	135
British Thomson-Houston Co., Ltd.	106	N.S. Battery Equipment Co., Ltd.	90
Brown, S. G., Ltd.	80	Paragon Rubber Co.	76
Brandes, Ltd.	30	Pedley, J., & Son, Ltd.	49
Bonnelle, Jos.	36	Portable Utilities Co., Ltd	40
Claremont, Johnson & Co. ...	30	Radio Instruments, Ltd.	82
Carpax Co., Ltd.	30	Siemens & English Electric Lamp Co., Ltd.	63
Efandem Co., Ltd.	60	S. Wales Wireless Installation Co., Ltd.	34
Elwell, C. F., Ltd.	60	Skefko Ball Bearing Co., Ltd. ...	30
Ellis & Sons	47	Sterling Telephone & Electric Co., Ltd.	35
General Electric Co., Ltd. ...	45	Siemens Bros. & Co., Ltd. ...	120
Hough, J. E., Ltd.	30	Wolf, F. (Berlin)	47
Hart Accumulator Co., Ltd. ...	40	Wilding-Cole, S.	33
Igranic Electric Co., Ltd. ...	70	Webber & Co., Ltd.	40
Jardine, John, Ltd.	45	Wilkinson Wright, Ltd.	63
Joesbury, W., & Son	36	*Western Mail*, Ltd.	43
Lissen, Ltd.	30	Zeitlin, V., & Sons	30
London Electric Wire Co. and Smiths, Ltd.	44		
McTaggart & Co.	64		
Millett, J.	36		

DIAMOND WIRELESS, LTD., late 184, Oxford Street, W.—A meeting of creditors was held on August 24th at 16, Fitzroy Street, W., when Mr. C. W. Harman, 80-2, Wardour Street, W.1, the liquidator in the voluntary liquidation of the company, reported that the liabilities amounted to £1,491, of which £680 was due to trade creditors and the balance to Mr. Jones. In addition, there were secured creditors for £12 who held security valued at £20, leaving a surplus of £8. The net assets were £77, leaving a deficiency of £1,414. The

company was incorporated on February 6th, 1924, with a nominal capital of £3,090, to acquire the business previously carried on by Mr. W. Jones, the purchase price being £2,000. With regard to Mr. Jones's claim for £810, it was stated that he would not claim against the estate. Accounts to March 31st last showed that there was a gross loss on the trading of £520. Mr. Jones stated that he was not in a position to make an offer to the creditors. It was decided that the meeting should be adjourned for 14 days with a view to Mr. Jones making an offer of 5s. in the £. The following are creditors:—

	£		£
Robinson, L., & Co.	110	Ross, Courtney & Co., Ltd. ...	20
Barclays Advertising Co.	88	Rothermel	23
Baltic Scandinavian Advertising Co.	88	British Empire Exhibition ...	27
Lighting, Heating & Glass, Ltd.	134	Batey, E. J.	49

ELECTROLITE, LTD., 138, Southbridge Road, Croydon.—The winding-up order in this matter was made on a creditor's petition. The statement of affairs shows liabilities of £10,565, and net assets of £1,974, which is insufficient by £8,398 to meet the loans of debenture bonds of £10,372. The issued share capital amounts to £500, so that there is a deficiency as regards the contributories of £11,065. The failure of the company is attributed to the slump in trade, depreciation in value of stock, and bad debts. The company was incorporated in December, 1912, as a private concern, and was formed to acquire as a going concern a lighting sundries business carried on at Croydon. The nominal capital was £1,000, of which £500 was issued between 1913 and 1922 to subscribers for cash. The price paid by the company for goodwill, stock, plant, book debts of the vendor's business was £500, a sum fixed by mutual agreement. Debentures covering all the assets and bearing interest at 5 per cent. are stated to have been issued for £500 in April, 1913, and for £1,500 in August, 1914, against cash advances for similar amounts on or about these dates. In addition, on August 23rd, 1921, a further debenture for £7,500 is stated to have been issued as a covering charge in respect of advances made to the company and liability in respect of guarantees given to third parties. In October, 1924, a creditor commenced an action for damages and an injunction to restrain the company from infringing a copyright; an interim injunction was refused, and the action continued, but on account of the action the holders of the debentures first issued, on February 28th, 1925, appointed a receiver. The Court has made an order appointing the Official Receiver as liquidator with a committee of inspection.

The following are creditors:—

	£		£
Bellamy, E. C., & Co.	20	Fenner, R., & Co. (Berlin) ...	85
Cox, Wiltcox & Co.	20	Willpnecht, C.	45
Domestic Tinware Manufacturers, Ltd.	20	Cross, W., & Son, Ltd.	35
Springett, M. A.	870	Paton, Calvert & Co., Ltd. ...	34
Export Gesellschaft	290	*Ironmonger*	25
Innovation Light Co., Ltd. ...	140	Frank, J. R., & Co.	25
Johnsen & Jorgenson Flint Glass, Ltd.	100	Wright, Fairbrother & Steel ...	25
Durrant, Mrs. B. A.	120	Wolchorer, T.	20
		Acme Tin Stamping Co.	20

ALKLUM ELECTRICS, LTD. — First meetings of creditors and contributories, September 2nd, at the County Court House, Halifax.

CARTER & MITCHELL, LTD.—Meeting of creditors at 24, Allsopp Street, Upper Baker Street, N.W., on September 8th. Liquidator, Mr. J. H. Higson, 11, Cheapside, Bradford.

Chinese Tariff Proposals.—*Reuter's Agency* reports that it has received from an authoritative Chinese source an assurance that China does not desire tariff autonomy for the purpose of imposing excessive duties and hampering trade. On the contrary, the proposals are characterised by "extreme moderation."

Conditions in Austria.—The *Monthly Review of Central Europe* published by the Anglo-Austrian Bank, Ltd., states that although unemployment among Austrian commercial employés is on the increase there has been a slight improvement in the metal and machine industries. In the electrical industries the situation is satisfactory as there is a sufficiency of orders to provide employment for some time.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 26th:—

Rogo. No. 460,350. Class 1. An anti-frothing solution used in connection with electric accumulators.—A. W. Creasey and G. S. Coop, trading in co-partnership, 24, Ruskin Avenue, Manor Park, E.12.

Radiac. No. 458,272. Class 8. Apparatus, instruments and accessories for use in radio telegraphy and telephony.—Radio Accessories, Ltd.

Sodium. No. 459,270. Class 8. Thermionic valves.—R. A. Rothermel, Ltd., 24-26, Maddox Street, W.1.

H. A. H. Hunt's (lettering and design). No. 459,510. Class 8. Electric batteries (not medical), induction coils, electric cables and radio-telephonic apparatus.—A. H. Hunt, Ltd., Tunstall Road, Croydon.

Atlas (lettering and design). No. 458,675. Class 8. Electric batteries (not for medical purposes), &c.—O. Ruhl (1922), Ltd., 85, City Road, E.C.2.

Supercision, F. C. H. (lettering and design). No. 460,458. Class 8. Electrical measuring instruments.—F. C. Heayberd & Co., 8 and 9, Talbot Court, Eastcheap, E.C.3.

German Electrical Goods in New Zealand.—The Christchurch (N.Z.) correspondent of the *Daily Mail* states that considerable quantities of German electrical material are getting into use in New Zealand. Most of this is of very inferior quality, and one of the Electric Power Boards has determined to have nothing whatever to do with German goods, even if they are lower in price than similar British manufactures. Instances have been reported where German motors have been sold with the name-plates removed.

A Novel Electric Sign.—A sign of large dimensions and incorporating a novel device has recently been erected for Messrs. Colgate, manufacturers of toilet requisites, between Charing Cross and Westminster Bridge on the south side of the Thames. The sign has an area of about 5,000 sq. ft. and is illuminated by over 4,000 "Osram" lamps. It incorporates a "thermometer" which by electro-mechanical means records the actual atmospheric temperature; this thermometer is 60 ft. in height and it has very legible markings in figures 20 in. high. The sign was designed and erected by Borough Electric Signs.

Salonica International Fair.—The Greek Minister in London informs us that, owing to the very short time that the prospective participants would have for the preparation and dispatch of their exhibits to Salonica to be in time for the opening of the Fair, the organisers have found it necessary to postpone the opening to a later date—probably until the Spring of 1926.

Travelling Exhibits.—The recent report of the Imperial Economic Committee, urging that those within the Empire should buy British goods, has met with response by the four leading railway companies of Great Britain. In order to demonstrate British-made goods to 300 cities and towns in England, Scotland, and Wales, the companies have constructed four exhibition trains of corridor carriages which, stocked with all manner of British commodities, will run over the various systems, making stays of from one to six days in railway station sidings. From outlying districts visitors will be taken to the exhibition trains by local excursions. The travelling displays will be seen free by the trade up to noon and by the public from then until 9 p.m. Salesman-demonstrators will travel with each train, and the displays will include wireless and electrical appliances.

Electricity at a Flower Show.—A flower show held recently at Chertsey gave the Woking Electric Supply Co., Ltd., which supplies energy in the district, an opportunity for a little propaganda work. A special marquee was pitched and a number of electrical appliances were arranged within it for demonstration purposes. In this way visitors to the show were able to gain an idea of the benefits of electric cooking, washing, ironing, &c. The accompanying illustration shows the cooking section in which there were two cookers and a number of smaller appliances as well as a card announcing the rates charged for cooking energy.

Electricity at a Chertsey Flower Show.

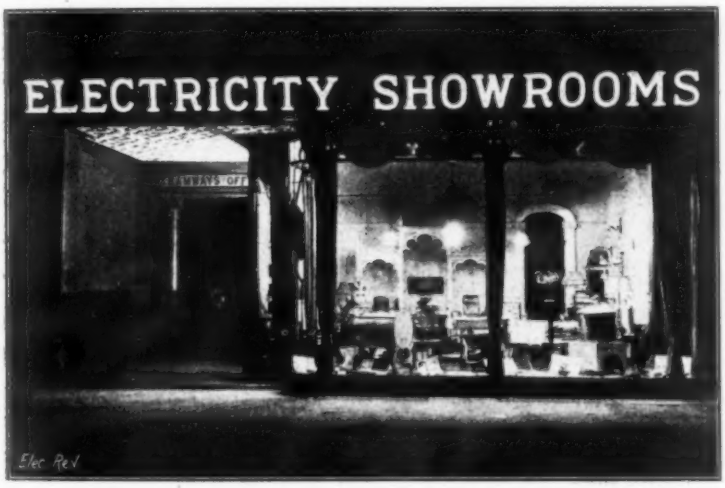
Spanish Radio Exhibition.—Plans are under consideration by local agents of radio apparatus manufacturers for the holding of another international radio exhibition in Madrid this year.

British Trade with Esthonia.—In the course of a report upon conditions in Esthonia which he recently forwarded to the Department of Overseas Trade (Stationery Office, 1s. net), Mr. H. Montgomery Grove (British Consul-General at Reval) says that British goods are very popular, and unless their trade competitors' prices are very much lower, the preference is for British goods. The use of electricity is advancing, and the demand for electrical fittings, goods and lamps should increase. It seems fairly certain that the construction of the Narva hydro-electric plant will be commenced this year, and this should lead to a largely increased demand for all electrical goods. This scheme projects the erection of a power station at Narva Waterfall in conjunction with a plant to extract nitrogen from the atmosphere. Should the project be successful, it is anticipated that Esthonia will become self-supporting in the matter of artificial manures. During 1924 the electric railway line between Reval and Nomme (8 km.) was constructed, and the number of passengers carried by it was 2,831,132 (more than double the Republic's population). Actual details of Esthonia's electrical imports are not given in the report, but it is stated that the imports of "machinery (not agricultural) and means of transport" amounted to 7 per cent. of the total; of this from a half to two-thirds came from Germany, then, a long way behind, come the United Kingdom and Sweden. There is no doubt that the difficulty which Germany has in granting credit and the rise in German prices for goods of all sorts did a great deal, during 1924, to assist the imports of British-made goods into Esthonia.

French Interest in Portuguese Scheme.—The North Portugal Waterfall Co., whose head office is in Lisbon, has acquired several concessions for the development of hydro-electric power on the Cavado River and its affluent, the Rabagao, about 45 miles north of Oporto. The banking firm of Pinto and Sotto Mayor, the Portuguese Government, and a group of French financiers are interested. Energy will be distributed in northern Portugal, especially in the city of Oporto. Work was begun on the first station in December, 1924, but only on a small scale. During the current year only preliminary work will be done, but it is hoped that by the summer of 1926 operations on a more extensive scale can be commenced. It is estimated that the completion of the undertaking will require more than five years. The chief problem will be raising the funds necessary to carry out the enterprise.—*Commerce Reports.*

Electrical Apparatus for South African Mines.—According to recently-published statistics showing the values of various classes of goods purchased from abroad by the South African mining companies during 1924, electrical machinery, spares, and fittings to the value of £621,277 were imported during the year.

The Southampton Corporation Electricity Showrooms.—Visitors to the meeting of the British Association could not fail to notice the Corporation Electricity Department's showrooms situated in a prominent position in Above Bar Street, one of the main thoroughfares of Southampton. The attractive display arranged in the windows, which is seen in the accompanying illustration, draws large crowds, both during the daytime and in the evening. In the course of the day demonstrations of electric washing and ironing are



The Southampton Corporation Electricity Showrooms.

given with "Thor" machines; at dusk a special lighting scheme carried out by the General Electric Co., Ltd., comes into play. This consists of batteries of "Gecoray" reflectors fitted with colour screens and controlled by a motor-driven flasher. A wide range of colour changes is produced by this means. Inside the showrooms is a large collection of electrical appliances of all kinds, from irons and other domestic apparatus to battery-charging devices. Jackson cookers are exhibited, this pattern being provided under a hire-purchase scheme which the department has instituted—with success.

American Loan for German City.—A loan of 32.5 million marks has been raised in the United States by the municipal authorities of Munich for the purpose of extending the electricity works and tramways in the city, &c.

Great Britain and Argentina.—The *Review of the River Plate*, in referring to the advantage which Great Britain possesses over Germany in her practically limitless credit, says:—"As yet the financial power of Great Britain has not been applied to its fullest extent in the conduct of her foreign trade outside the Empire, but one is inclined to think that this will be done ere many months are past, either by a system of bounties or in the shape of long-term credits granted to those manufacturers who are in a position to employ large numbers of workmen, provided that they can meet the credit needs of their customers. In this respect Argentina offers a very fruitful field, and it would not surprise us to find Great Britain co-operating with this Republic on some such basis before many months are out."

Australian Tariff Decisions.—Among the recent decisions of the Customs Department are the following:—Unmachined castings for the frames of tramcar motors, free under the British preferential tariff; free under the intermediate tariff; 10 per cent. under the general tariff. Transformers 3,000 kVA, 22,000/4,150-V, free; 5 per cent.; 10 per cent.

Electrical Progress in Spain.—In the course of a report upon trade conditions in Spain, *Commerce Reports* says that the new improvements in hydro-electric and municipal electric plants are resulting in a continual use of new electrical equipment.

Dutch Trade in Radio Apparatus.—Official statistics of Holland's foreign trade in apparatus for radio telegraphy and telephony show that the imports in the first half of the current year represented a value of 1,235,000 fl., as compared with 537,000 fl. in the corresponding half of 1924. Great Britain is credited with having supplied goods to the value of 401,000 fl., Germany 385,000 fl., France 175,000 fl., and the United States 163,000 fl. On the other hand, the exports from Holland rose from 137,000 fl. in the first half of 1924 to 378,000 fl. in the first six months of the current year. Of this, goods to the value of 223,000 fl. were sent to Great Britain, 35,000 fl. to Germany, and 67,000 fl. to the Dutch East Indies. The exports of metal-filament lamps, which include valves, declined from 12,002,000 fl. in the first half of 1924 to 10,835,000 fl. in the equivalent period of this year. The imports also declined from 485,000 fl. to 412,000 fl.

Electrical Trades Commercial Travellers' Association.—A general meeting of the Association is to be held this evening (Friday) at the St. Bride Institute. The agenda includes the election of vice-presidents, chairman's and treasurer's reports, &c. An invitation is extended to visitors.

The Future of Wembley.—The Board of the British Empire Exhibition has appointed a committee, with Mr. J. H. Thomas, M.P., as chairman, to consider offers for the disposal of the Exhibition. A syndicate headed by Mr. H. Day, a Socialist Member of Parliament, has already made an offer for the ground and buildings with a view to the formation of a housing estate.

Trade with China.—In the report of the Maritime Customs Board on the Foreign Trade of China for 1924, which has just reached us, it is stated that during the year under review, there was no improvement on the previous year so far as electrical machinery was concerned. The continued state of unrest hampered and retarded the development of this industry, whilst intense international competition depressed prices to such an extent that the year's result is reported to have been far from profitable to those engaged in the trade. Nevertheless, a few important orders were placed for power-plant extensions by the Changchow Electricity Works, the Pei Piao Coal-mining Company, the Soochow Electricity Works, the Chee Hsin Cement Works, and the Amoy Electric Light and Power Company, most of which were secured by manufacturers in Continental Europe. British manufacturers, on the other hand, secured contracts for electrical machinery at Tengchowfu and Lincheng in Shantung, and for plant extensions in Manchuria, Honan, and Fukien. Trade in electrical accessories was much the same as in 1923, with a brisk demand for electric fans. Competition in the latter line of business is also growing very keen, European manufacturers coming well to the front, but the bulk of the trade is still in American hands. The total value of electrical materials and fittings imported into China from abroad was 8.2 million taels in 1924, as compared with 8.1 million in 1923, and the share taken by the principal countries of origin during the past two years was as follows:—

	1923. Value. Taels.	1924. Value. Taels.	Inc. or dec. Taels.
United States	1,322,002	1,215,343	−106,659
Belgium	232,707	315,231	+ 82,524
Germany	2,064,119	2,170,973	+106,854
Great Britain	1,244,519	1,236,112	− 8,407
Holland	219,062	366,836	+147,774
Japan	2,495,131	2,170,844	−324,287

American Electrical Exports. — The official statistics of the foreign trade of the United States during June show that the value of electrical goods and machinery exported was $5,991,636. This compares unfavourably with the total for June, 1924, which was $7,201,223. In the electrical machinery section there were some large decreases, notably in the case of d.c. generators—from $295,557 to $46,652; accessories and parts for generators—from $229,471 to $52,012; transformers—from $459,798 to $222,865; switches and circuit breakers—from $372,749 to $90,826; electric railway locomotives—from $468,680 to no recorded value; and accessories and parts for motors—from $225,985 to $117,384. There were also heavy falls in the exports of telephone switchboards—from $127,549 to $31,444; unspecified electrical apparatus—from $600,063 to $440,562; and bare copper wire—from $227,399 to $114,952. On the other hand, there were a number of important increases, the most prominent of which occurred in the case of radio apparatus, which rose from $307,884 to $670,605. The value of exported a.c. generators rose from $17,795 to $81,532; that of domestic appliances from $156,041 to $204,296; industrial electric furnaces and ovens from $16,744 to $34,015; sparking plugs, magnetos and other ignition apparatus from $178,408 to $394,899; and insulated copper wires and cables from $252,448 to $318,856. Figures for the past fiscal year (ended June 30th last) show that the United States exported

electrical machinery and apparatus of a total value of $66.9 million, as compared with $68.8 million in 1923-24, and only $21.1 million (average) from 1910 to 1914.

Book Notices.—"Aluminium Overhead Conductors." By the British Aluminium Co., Ltd. Pp. xi + 150; fully illustrated. Price 10s. 6d.—Although in the main this little book is a treatise on the use of aluminium as a medium for the transmission of electrical energy, much valuable information is contained therein treating of transmission lines in general. A wealth of data both from calculation and experiment is supported by curves and tables, the latter being prepared to meet the specific requirements of the practical engineer. Among the many illustrations are a number of views depicting notable transmission systems using aluminium conductors in various parts of the world. We understand that the British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.4, will send a copy of the book to any responsible engineer interested in the subject.

"The Fuelling and Lubrication of Heavy Oil Engines."—In this small publication of Messrs. Shell-Mex, Ltd., considerable technical information and many data are given concerning the requirements of heavy oil engines for both fuelling and lubrication. Tables depicting the running conditions of such engines, and comparing the fuel costs for oil, gas and steam engines, make an interesting addition.

"Poppy Day Report, 1924." London: The British Legion.—This contains exhaustive details of the results of the sale of poppies on "Poppy Day," 1924. Mention is also made of a few typical cases assisted during the past year, and particulars are given of wreaths, the sale of which helps the Legion's benevolent fund.

Local Exhibition.—BERMONDSEY.—The Borough Electricity Department is organising an electrical exhibition at the Town Hall for the week commencing September 14th.

New Belgian Companies.—Among the recently-formed Belgian companies are the following:—The "Osram" S.A., with a capital of 500,000 fr., to manufacture and sell electric lamps, &c.; the Cie. Continentale "Trialmo," capital 200,000 fr., to produce radio-telephone apparatus, &c.; Accumulateurs Gaulois, capital 120,000 fr.; and the Chauffage et Electricité, capital 475,000 fr., to deal with central heating and electrical installations.

Lighting and Power Notes.

Australia. — MELBOURNE. — According to the *Industrial Australian and Mining Standard*, the Electric Supply Committee of the City Council has recommended that, owing to the increase in the demand for electricity, tenders should be invited for the supply and delivery of a 5,500-kW turbo-alternator, which is to be substituted for the existing 2,500-kW turbo-alternator at the Council's power station. The old alternator is stated to be obsolete, and insufficient for present requirements. The cost of the new one is estimated at £33,000.

"SERVICE" RENDERED.—The Adelaide Electric Supply Co., of South Australia, has, we learn, lately acquired a fleet of ten "Triumph" motor-cycles to enable its service staff to promptly answer any calls.

Barnsley.—LOAN.—The Town Council has applied for sanction to a loan of £5,230 for cable extensions, including public lighting, for Ardsley Hill.

Barrow-in-Furness.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. H. R. Burnett) for the year ended March 31st last show a total income of £89,113, as compared with £75,647. Working expenses amounted to £58,472, as against £47,765, leaving a gross surplus of £30,641 (£27,882). After providing for capital charges, there was a net surplus of £5,433, as compared with £2,195 in 1923-24. The capital expenditure during the year, which included £10,500 for machinery and plant, and £9,082 for mains, amounted to £23,045. The electrical energy sold increased from 8,494,387 to 11,379,093 kWh, and the load factor from 26.76 to 37.33 per cent. A new water-tube boiler was installed during the year, and three 75-kW generators were replaced by two 750-kW rotary converters. In connection with the proposed hydro-electric station at Backbarrow, a complete survey of the proposed site of the power house has been made by Messrs. Vickers, and plans of the proposed scheme are in course of preparation.

Bury.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. J. G. Potts), for the year ended March 31st last, record a total income of £90,563, as compared with £83,294 in the preceding year. Working expenses were £54,693, as against £50,385, leaving a gross profit of £36,239 (£32,909). After payment of capital charges, &c., a net surplus of £2,121 remained, as compared with £1,501 in 1923-24. The capital expenditure during the year, which included £10,969 for plant, amounted to £26,588. The electrical energy sold increased by 457,635 kWh to 18,479,648 kWh and the maximum supply demanded from 7,080 to 7,690 kW. During the year, work was commenced on the change-over of the system of supply from d.c. to a.c. In connection with the bulk supply to Heywood, a new trunk feeder was laid during the year.

Continental.—SWITZERLAND.—The Swiss Government has recently granted a concession for the construction of a dam and the erection of a hydro-electric station to utilise the water power of Lake Wallen.

ITALY.—The Italian Government has recently granted powers for the establishment of a 12,000-V transmission line between Cassano Spinola and Villaro Enagnano by the Società Distribuzioni Elettriche Iria, for a 11,500-V line between Paiseo and Forno Allione (Brescia) by the Società Alti Forni Franchi Gregorini, a 15,000-V line between the Mesce and Gaudarena power stations at Terida, Cuneo, by the Società Elettro Mineraria, and a 30,000-V line between Rimasco and Valsesia (Novara) by the Società Idro-elettrica Valsesia.

FRANCE.—According to the annual report of the Société de Force et Lumière des Pyrenées the company has recently acquired the electricity undertaking at Montgalliard and the Lac Bleu hydro-electric station of the Société de l'Energie Industrielle. In order to meet the increasing demand arrangements are in hand for an extension of the distribution mains in the Upper Pyrenees.

CZECHO-SLOVAKIA.—*Commerce Reports* states that a meeting of representatives of the cities of Uzhorod, Mukacevo, and Berehov has been held and plans made to form a company to construct a municipal hydro-electric power system in that neighbourhood.

BULGARIA.—With the assistance of the Government and local authorities, a syndicate in Sofia is erecting several hydro-electric plants in the Rhodopege mountains, all of which will be connected up to a central distribution station.

Earby.—ELECTRICITY SCHEME.—At a meeting of the Urban District Council, on August 20th, a resolution was passed stating that it was desirable that the supply and distribution of electricity in the district should be developed under the control of local authorities. It was decided to request the Electricity Commissioners to prepare a scheme for the guidance of local authorities concerned.

East Preston (Sussex).—INQUIRY.—In response to a communication from the local Council, the Electricity Commissioners have intimated their decision to hold an inquiry into the applications of the East Preston Rural District Council and the Worthing Corporation for Special Orders to supply electricity in the area.

Glasgow.—WIRING OF SMALL HOUSES.—In connection with the wiring of private premises it was reported to the Corporation Electricity Committee that 31 houses were added in July, making the total to date 1,099, while 52 applications were made for the hire of domestic appliances, the total to date being 7,284.

MAINS EXTENSIONS.—The Committee has recommended that the manager be authorised to proceed with the extension of mains during the winter at a cost of £90,140, and that application be made to the Unemployment Grants Committee for a grant towards the cost of the work.

LOAN.—The engineer has reported that for the purchase of heating and cooking apparatus to be let out on hire, for the cost of showroom premises already purchased, and the extension of offices, a sum of £160,000 will be required for the next three years. The Electricity Committee has recommended that application be made for sanction to the borrowing of this amount.

India.—ELECTRICAL DEVELOPMENT IN MYSORE.—The total electric power that is now being generated at Sivasamudram is about 32,000 h.p., the whole of which has already been taken up. The demand for additional power likely to be required during the next three years, including that for small industries, fans and other domestic purposes, is estimated at 12,800 h.p. After a careful investigation of the various schemes for the generation of the additional power required, the Government has sanctioned necessary estimates for a seventh installation, providing for the generation of an additional 14,000 h.p. at Sivasamudram generating station at a total approximate cost of Rs. 45¼ lacs, including subsidiary works for the transmission and distribution of the power. The development of the Krishnarajasagara station is deferred for the present.—*Indian Engineering.*

Irish Free State.—DALKEY (CO. DUBLIN).—At a recent meeting of the Urban District Council a committee was appointed to ascertain whether the Urban District Council of Kingstown would be willing to undertake the electric lighting of the town, and if so the probable cost of the scheme.

Mid-Cheshire.—NEW ELECTRICITY CHARGES.—The Mid-Cheshire Electricity Supply Co. announces the following new scale of charges for electricity as from October 1st next:—Flat rate: Lighting, 9½d. per kWh. Heating: 2d. per kWh. Power: First 100 kWh per quarter per h.p. connected, 3½d., next 100 kWh 2½d., beyond, 1½d. Combined lighting, heating, cooking and domestic power contract system: A fixed charge per quarter dependent upon the connections plus a charge of 2d. per kWh for the first 200 kWh and 1d. beyond for the winter quarters, and 1d. per kWh per quarter for all electricity consumed in the summer quarters.

North Wales.—ELECTRICITY SUPPLY.—The Merioneth County Council has granted the North Wales Power Co., Ltd., permission to carry overhead transmission lines from Llanfrothen to Maentwrog, and from Maentwrog to Blaenau Festiniog.

(*Continued on page 383.*)

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A Scottish Colliery Power Station.

The Fife Coal Company's Electricity Generating Plant.

THE supply of electrical energy to collieries is beset with difficulties which prevent any hard and fast rules being laid down as to the mode of deriving the supply. Providing the conditions, however, are suitable to enable a central station to operate efficiently, then there is no doubt about the economies which will result from the utilisation of such a source of electrical energy—an example being the Fife Coal Co.'s Kelty station, adjacent to the Aitken pit, which generates the whole of the electricity used by the company at its numerous pits in the Kelty and Cowdenbeath districts as already explained.*

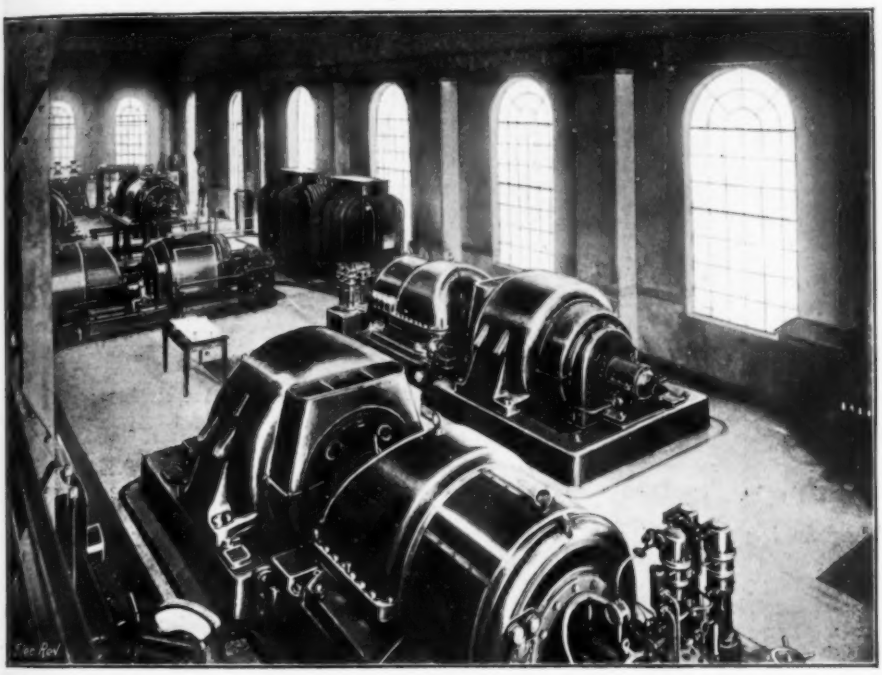


Fig. 1.—Turbo-generator House, Kelty Power Station.

The company utilises electricity for all purposes on the surface and underground; it is transmitted from the power house to the 14 pits already electrified by means of transmission lines, part of which is in the form of a ring main, of a total length of 17 miles, the pressure of 12 miles of line being 3,000 volts, while the remaining five miles of line is operated at 6,600 volts, at which voltage all future extensions are to be carried out. Except at certain railway and road crossings, where short lengths of cable are used, the whole of the lines are carried overhead on wood poles.

Practically all colliery power stations have been evolved from small beginnings, their capacity having been gradually built up as confidence in the application of electrical methods to mining processes was increased. In view of the facts that some years must elapse before the capital expenditure necessary at the commencement can be economically utilised, and that the final power requirements can only be guessed at, the problem of determining the source, or method, of supplying power to a new colliery undertaking is extremely complicated. It is accordingly not surprising that colliery companies prefer to develop gradually by the use of steam winding engines, generally the largest individual units of a colliery plant, in conjunction with mixed-pressure turbo-generators to carry the auxiliary load, notwithstanding the lower efficiency of such a scheme as a whole, as compared with the all-electric method. Nevertheless, there is a good deal of misconception with regard to such a scheme, for it is at the best but a compromise. The exhaust-steam turbine is strictly nothing but a utiliser of steam that would otherwise be wasted in connection with existing plant, and its adoption in the case of a new colliery undertaking depends on the relative proportion of the available exhaust steam to the auxiliary power requirements. In the case of the undertaking under consideration, however, the fourteen collieries have been completely electrified, including the winding engines, and consequently the whole of the boilers and steam plant at these pits have been discarded and removed. The 16,500-kW Kelty power house, the turbine room of which is illustrated in fig. 1, contains six turbo-alternators, the total capacity of which is 22,000 kVA; a mixed-pressure British Thomson-Houston turbo-generator was placed in commission in October, 1919, to utilise the steam exhausted by the winding engine at the adjacent Aitken pit. The turbo-alternator comprises one mixed-pressure set of 1,500 kW capacity and the turbine is of the three-stage horizontal Curtis type, running at 3,000 r.p.m.; it is coupled direct to

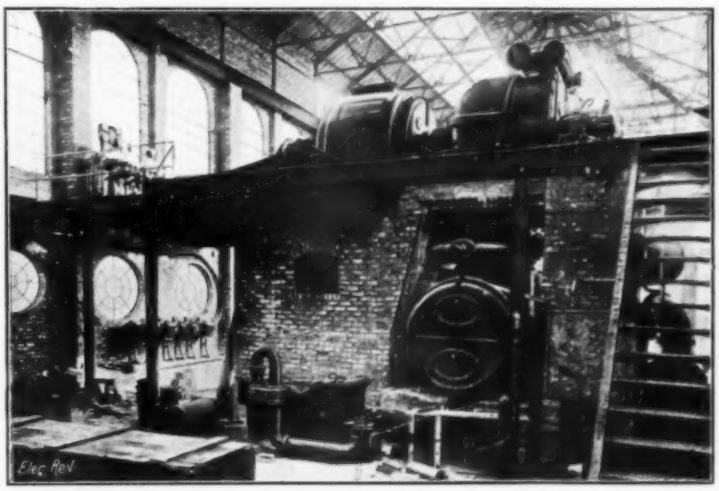


Fig. 2.—Re-erection of 3,000-kW Generator in New Turbine House.

* ELEC. REV., May 15th, 1925; pp. 779-81.

an alternator designed to give a normal output of 1,875 kVA at 80 per cent. power factor, 3,300 volts, three-phase, 50 cycles, the overload capacity being 25 per cent. for two hours. The steam conditions are: High pressure, 200 lb. per sq. in. gauge, superheated 200 deg. F., and the vacuum at full load is 28 in.; low pressure, 16 lb. per sq. in. absolute. This machine is working in conjunction with jet condensing plant of the "Korting" type supplied by Messrs. Samuel Bullock and Co., and a steam-driven exciting set, which can also be used for station lighting purposes, is located in the condenser basement, as shown in fig. 5, although the mixed-pressure set is a self-excited machine. Means are

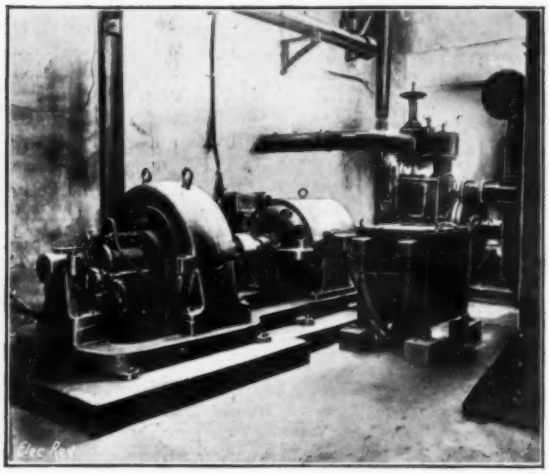


Fig. 3.—Motor-driven Exciter Set.

thus provided of starting the generating station after a shut down with steam obtainable from an independent external source. The main generating plant consists of three Fraser & Chalmers-General Electric Co. 50-cycle, 3-phase, 3,300-volt steam turbo-alternators running at a speed of 3,000 r.p.m. and of a capacity of 3,000 kW each. The turbine room also contains a British Thomson-Houston 50-cycle, 3-phase, 3,000-r.p.m. turbo-generator, while a duplicate machine was, on the occasion of our visit, being re-erected in an extension of the power house. These two sets were originally built by the B.T.-H. Co. to the order of the Ministry of Munitions, having been installed in 1916 at the Gretna Government munition factory. They were later purchased by the Fife Coal Co. and, together with their auxiliary plant, were dismantled, removed to Kelty, and re-erected by the Coal Co.'s engineering staff without outside assistance. Fig. 2 is a view of one of these machines during the course of its re-erection at Kelty. The steam conditions for the whole plant are a gauge pressure of 200 lb. per sq. in., superheated 200 deg. F., and the B.T.-H. sets were designed to give a normal output of 4,000 kVA at 75 per cent. power factor, 6,600 volts. Their overload capacity is 25 per cent. for two hours.

The condensing plant for both these sets is of the surface type manufactured by Messrs. Cole, Marchent and Morley, each being designed to deal with 43,000 lb. of exhaust steam per hour and capable of maintaining a vacuum of 28-in. mercury when supplied with 260,000 gallons of cooling water per hour at a temperature of 75 deg. F. Each air pump, which are of the Edwards three-throw type, is driven by a 17-h.p., 440-volt, three-phase, 50-cycle B.T.-H. motor, whilst each circulating pump is driven by a 100-h.p. B.T.-H. motor. The three G.E.C. turbines have Bullock condensers of the Korting jet type, one of which is illustrated in fig. 4, a somewhat unusual feature; this is, of course, pre-war plant, and it has operated quite satisfactorily. The condenser auxiliary plant consists of two sets of Platt 4,080-gallon, 40 ft. head, 550-r.p.m. pumps, driven by

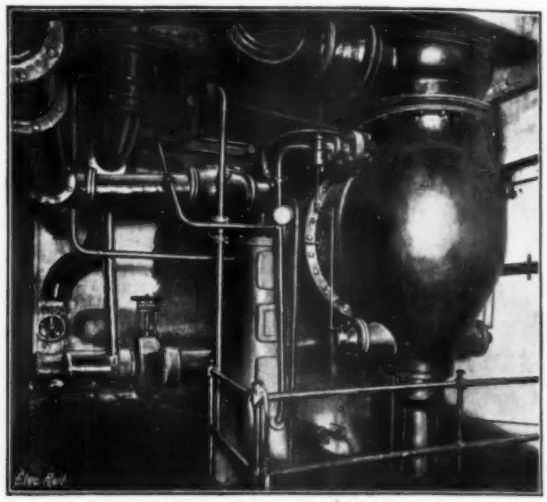


Fig. 4.—A Korting-type Bullock Jet Condenser.

Belliss & Morcom 3-cylinder steam engines; and two W. H. Allen sets, each comprising two pumps on one shaft driven direct by a G.E.C. 3-phase, 50-cycle, 730-r.p.m., 3,000-volt, 120-h.p. motor with G.E.C. switchgear, as shown in figs. 3 and 5.

In conjunction with an electrically-driven Weir water pump and a spray filter, a "Sirocco" fan draws outside air into the basement, whence it passes up through the G.E.C. alternators, whilst the two latest B.T.-H. generators are each provided with a Heenan & Froude

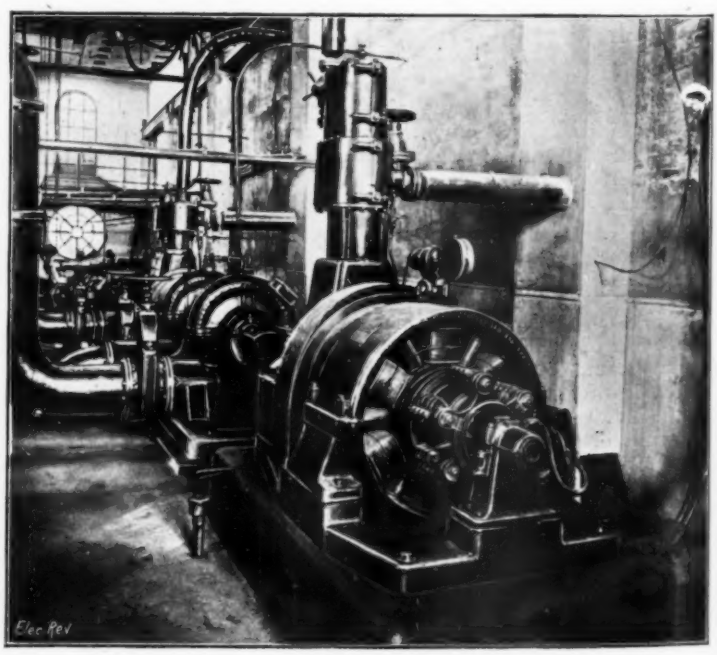


Fig. 5.—Steam-driven Exciter and Condenser Pumps.

air washer with B.T.-H. motors. In the basement there is a Fox oil filter, the station cranes being by Anderson, Grice & Co., Ltd.; they are of 30 tons capacity, and are electrically operated.

Although the three main B.T.-H. turbo-generators are provided with exciters mounted as usual on shaft extensions, the G.E.C. machines are not self-excited. Accordingly, three separate exciting machines have been provided: two of them are G.E.C. sets, each consisting of

a 69-kW. 50-116-volt, 225-r.p.m. d.c. generator coupled direct to a 130-h.p., 3,000-, 50-cycle motor as shown in fig. 3, while the third (which has already been referred to, fig. 5) is a 46-kW, 6-pole, 115-volt, B.T.-H. d.c. generator driven direct by a verticle single-cylinder Belliss & Morcom steam engine at 480 r.p.m. Thus a very flexible means is available of exciting any one, or all, of the main generating sets through the separate switchboard illustrated in fig. 7 with B.T.-H. control, which is arranged to trip the main generator switch and break the field circuit in the event of a fault developing.

To form a link between the two 6,600- and the four 3,000-volt generating sets and the respective portions of the transmission system, two Johnson and Phillips 1,500-kVA, three-phase, 50-cycle transformers have been provided, their h.p. windings being connected in star and the l.p. sides delta connected. At present they are temporarily situated in the turbine house, as shown in fig. 1, and their switch panels are of the Reyrolle draw-out metal-clad type, each of 300 amp. capacity, with overload protection and the middle pole of the overload relay arranged for earth-leakage protection. Synchronising equipment is mounted on a swinging frame at the right-hand end of the board, two other panels of which control two 6,600-V feeders to the Nos. 1 and 2 Kirkford pits, being provided with overload protection, and the third is a 600-amp. generator panel having Merz-Price mid-point protection and an instrument bracket mounted on the top of the bus-bar chamber. These panels will be moved into the new turbine house when completed and added to similar Reyrolle gear for the other B.T.-H. generator. The 3,000-volt switchgear consists of 15 complete sets of generator and feeder equipment of the remote mechanically-operated B.T.-H. type. The isolators, bus-bars, and oil switches are housed in moulded stone cells on a gallery, the control panels being on the engine-room floor below, as shown in fig. 6; there are duplicate bus-bars throughout, and each set can be divided in two sections by means of bus-sectionalising equipment.

The fuel burned is in the form of slack coal (3/16 mesh), with a 25 per cent. ash content and a calorific value of anything from 7,000 to 10,000 B.th.u.; it is conveyed from the adjacent Aitken pit screening plant to the boiler-house dumping pit, fig. 9, which also shows the Babcock & Wilcox suction ash plant hopper, by means of an electrically-driven underground belt conveyor, by the Blantyre Engineering Co., with Reyrolle switchgear. Thence the coal is elevated by bucket conveyors to the boiler bunkers.

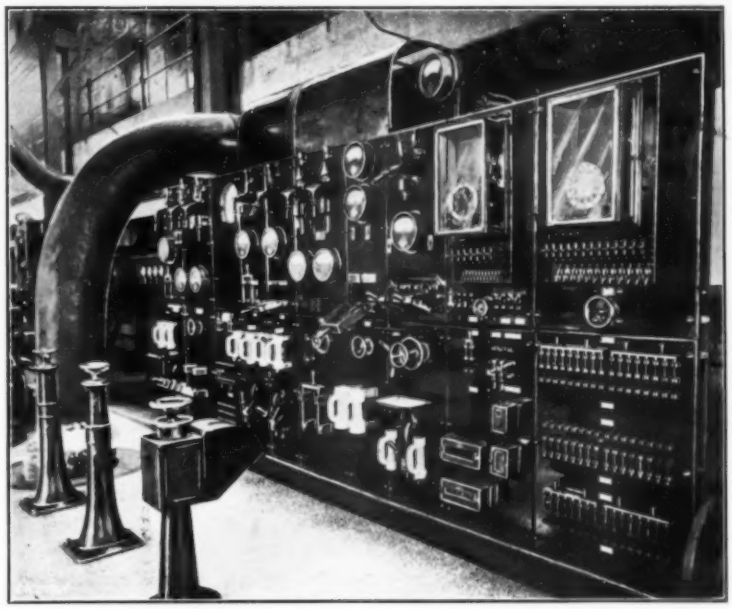


Fig. 7.—Main Generator Exciting Switchboard.

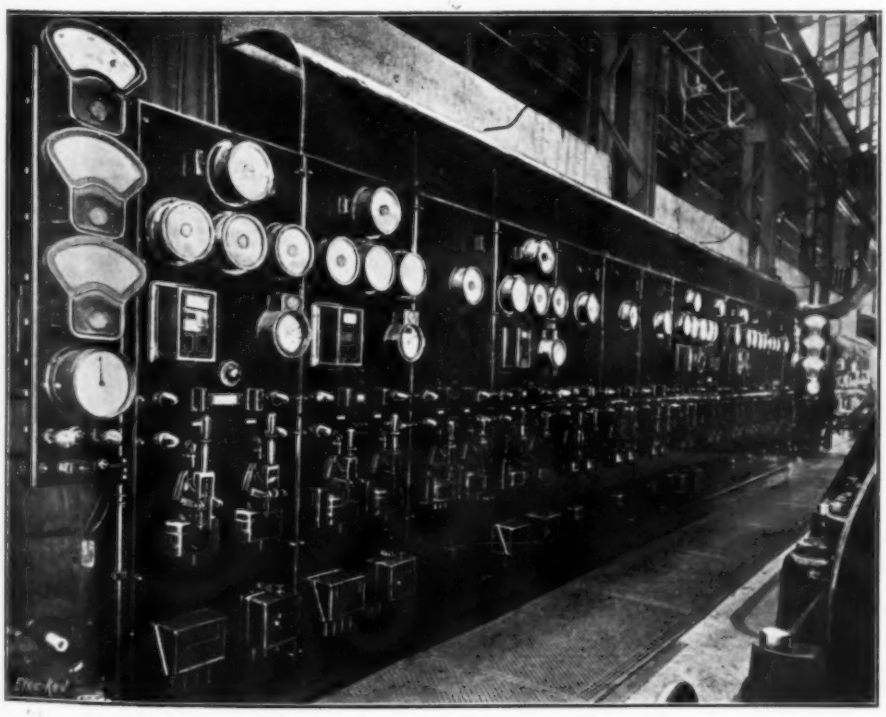


Fig. 6.—Main 3,000-V Generator and Feeder Control Board.

The present boiler house, a section of which is illustrated in fig. 8, contains two Babcock & Wilcox 18,000-lb. per hour boilers and three 27,000-lb. and three 30,000-lb. Stirling boilers. Five of them are equipped with Erith-Riley self-cleaning underfeed stokers, and the others with Erith-Roe stokers, which are driven by drip-proof 10-h.p. commutator motors of the a.c. 50-cycle, variable-speed (450- to 1,350-r.p.m.) B.T.-H. type. Steam is generated at a pressure of 200 lb. per sq. in. and superheated to a total temperature of 600 deg. F. A 35-h.p. electrically-driven forced-draught fan is provided for each boiler, and three "Sirocco" induced-draught fans are also available, but were not being used at the time of our visit; the single 215-ft. high steel chimney creates a draught equivalent to 1 in. of water. Economisers are not used at present, but will be installed in the new boiler house. The four Weir steam-driven reciprocating boiler feed-

water pumps each have a 9-in. bucket, 12-in. piston, and a 24-in. stroke; Crosby double-feed regulators and an Erith feed heater are installed with water-softening and oil-separating plant, the main and auxiliary steam ranges and feed water mains being arranged on the ring principle.

All the auxiliary plant which is electrically driven, with the exception of the 3,000-V pump motors mentioned earlier, are fed through a 500-volt a.c. ring main, the motor starters being of the Ellison and Reyrolle types. The source of supply, as shown in fig. 10, is one 460-kVA and two 202.5-kVA Brush, 50-cycle, 3-phase, oil-cooled, 3,000/500-V transformers, with B.T.-H. switchgear on

Fig. 8.—Section of the Existing Boiler House.

the l.p. side and Reyrolle switches on h.p. side; one 6,600/500-V transformer is capable of being changed over or of operating in parallel with the others, while two 25-kVA Johnson & Phillips 3-phase, 50-cycle, 500/100-V transformers are delta connected on their h.p. side and in star on their l.p. side to supply the lighting circuits. It is of interest to note that in case of accident any rotor of any of the main G.E.C. machines can be replaced immediately, for a spare turbine rotor and a spare generator armature are available in the station.

In conclusion, it may be mentioned that the station extensions, as already indicated, will consist of a new turbo-generator house (in which the machine shown in fig. 2 has been re-erected) and a parallel boiler house, both at right angles to the old turbine room, which is 125 ft. 6 in. long by 51 ft. 5 in. wide. The new turbine room is 140 ft. 4 in. long and 54 ft. 6 in. wide, and will accommodate, besides the machine shown in fig. 2, three 6,000-kW turbo-alternators and six transformers. The company has generating plant of 7,500 kW capacity installed at collieries in other districts, Mr. J. R. Copping, the Fife Coal Co.'s chief electrical and mechanical engineer, being responsible for the whole of the plant, together with the laying out of the extensions. We have to thank him for the facilities placed at our disposal on the occasion of our visit to the Fifeshire coalfield. The total output of the generating station six months ago was 1,045,000 kWh per week.

Technical Information.

How to Make Use of it.

By W. R. N.

THERE is no doubt that most engineers worthy of the name have read much valuable matter. How many men, however, say a month later, are able to recall salient points, or to lay hands upon any particular article which they have mentally noted and approved? Some few are able to do so, though not many without having recourse to mechanical means for aiding the memory. The pre-

Fig. 9.—Coal Elevator Pit and Ash Hopper.

sent writer finds it necessary to keep a note book wherein he makes his entries of technical treasure trove.

An excellent plan is to use a sectionalised note book. This reduces the manual labour involved, in that it largely cuts out the work of classification and cross indexing. The subjects take their own copy at the initial entry. All that is necessary is to book the work up intelligently. Not the least important aid is the provision of a special column to cover actual location of article. It may not always be an easy matter to procure a copy other than the one which has been read. Actually where that copy finds a home is, therefore, of some consequence. The following table, dealing with the subject of metallurgy, exemplifies what is meant:—

C.—METALLURGY AND MICROGRAPHY.

Ref.	Title of Article &c.	Author.	Source.	Location.
1	Non-ferrous Metals	D. P. Cowell	Engineering Era	L. Arundel & Co.'s staff library
2	Duralumin	Dr. D. C. Roper	Metal World	K. Burton.
3	Micrography of Stainless Steels	R. Malone, B.Sc.	Proc. Eng. Inst.	Lideman's library

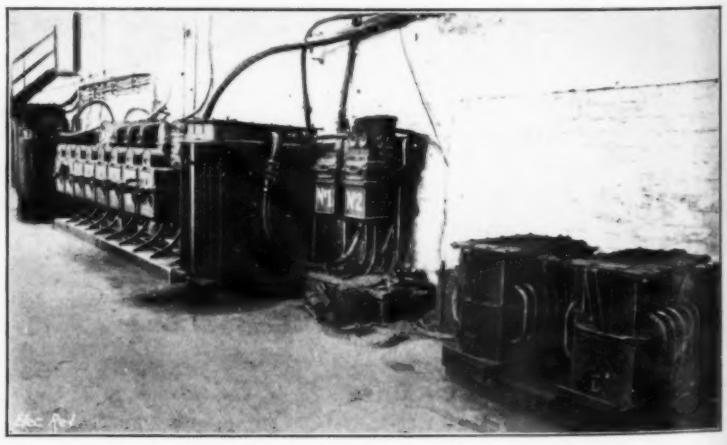


Fig. 10.—Station Auxiliary Transformers and Switchgear.

The existing machinery of technical journal clubs can usually be made use of. The necessary innovation is such that in most cases it would affect the working very little; and it need not interfere with the ordinary routine at all. The members would be asked to note down in some convenient form such articles as arrested their attention and seemed worthy of serious consideration. Exactly *how* the notes are made, or what form

they take, is of secondary importance. The table given below illustrates one method. Doubtless something much better suited to existing conditions will suggest itself to those interested. The blank but ruled form would be pasted on every magazine or journal issued. Roneo-ed copies of the form prove admirable for the purpose.

THE "ENGINEERS' REVIEW," JANUARY, 1924.

Name.	Date received.	Useful articles.	Page.
M. Panter	2/2/'24	Turbine Disks	112
		Lubrication of Gearing	198
T. Bird.	5/2/'24	The Engineer as Organiser	142
A. K. Sylvester	10/2/'24	Electrification of Railways	135
P. Brant	12/2/'24	Water v. Steam Power	188

Finally, if the periodicals concerned are kept in a staff library it may repay the members if they arrange that an indexed register—either book or card index—be kept of such entries. Either one person may take on the work or different members in rotation for stated periods.

Lighting and Power Notes.

(*Continued from page 378.*)

Oldham.—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. F. L. Ogden, on the working of the Corporation electricity undertaking for the year ended March 31st last, shows a total revenue of £233,448, and working expenditure of £145,949, leaving a gross profit of £87,498. The previous year's figures were: Income, £205,439; working expenses, £113,130; gross profit, £92,309. To the gross profit was added a balance of £18,956 from the past year's account, a Government grant of £500 in respect of relief work, and interest on loans £7,759, making a total of £114,714. After deducting capital charges, &c., transferring £10,955 to reserve fund, and £8,000 to plant insurance fund, a balance of £21,652 was carried forward. During the year, £59,320 was spent on capital acount, the chief items being £31,975 for mains, and £18,536 for buildings, machinery and plant. The sales of electrical energy increased from 34,576,979 to 41,444,810 kWh, and the maximum supply demanded from 19,484 to 22,043 kW. The average price per kWh obtained fell from 1.426d. to 1.352d. A new 6,000 kW turbo-alternator and additional e.h.p. switchgear were installed during the year, and a scheme was submitted to the Electricity Commissioners for the erection of a new power station at Chadderton. Sanction was received to the change-over of the system of supply from d.c. to a.c.

Padiham.—ELECTRICITY SUPPLY.—Representatives of the Town Council have interviewed representatives of the Lancashire Electric Power Co., to discuss the terms on which the company will distribute electricity in Padiham area. The manager of the company stated that it was proceeding with the work of supplying Clitheroe and places *en route*, and it would be eight months before Padiham could be supplied.

Plympton.—ELECTRICITY COMMISSIONERS' DECISION.—The decision of the Electricity Commissioners on the applications of the Plymouth Corporation, Plympton Rural District Council, and Messrs. Heath & Co. for power to supply electricity in the Plympton rural district, which was the subject of an inquiry which concluded in London on May 9th, was made known to the authorities concerned on August 21st. The Commissioners have rejected the applications of the Plymouth Corporation and Messrs. Heath & Co., and granted the application of the Plympton Rural District Council for a Special Order to supply electricity in the whole of the rural district. The Plympton Rural District Council has come to an agreement to purchase the Plympton undertaking of Messrs. Heath and Co. for £7,000, and proposes to take all its supply from Plymouth, distributing it by means of sub-stations in the chief centres of population.

Salford.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer, Mr. S. J. Watson) for the year ended March 31st last, records a total revenue of £281,595, as compared with £269,169 in 1923-24. The working costs, including bulk supply purchased, were £171,173, as against £156,388, leaving a gross profit of £110,422 £112,781). Interest and sinking fund charges accounted for £83,361, and there was a net profit of £27,061, as compared with £41,015 in the preceding year. Of this amount £10,000 was contributed to the district fund, and the balance is to be transferred to the reserve and renewals fund. The capital expenditure during the year amounted to £263,315, the chief item being £205,979 for plant, &c., at Agecroft power station. The sales of electrical energy increased from 38,746,444 to 44,744,494 kWh, of which 4,736,012 kWh was purchased from Manchester Corporation. The average price per kWh obtained fell from 1.65d. to 1.49d., and the maximum supply demanded rose from 17,094 to 18,647 kW. The agreement with the Manchester Corporation for the supply of electricity in bulk expired on March 31st last, and negotiations are pending between the two Corporations for an agreement for reciprocal, emergency, and week-end supplies. During the year 12 additional transformer sub-stations were connected up to the 6,600-V system, making a total of 50 sub-stations.

South Shields.—LOANS.—The Electricity Committee is applying for sanction to loans of £30,000 for services, £40,000 for mains extensions, £10,000 for meters, and £2,000 for transformers.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Prestatyn Urban District Council to supply electricity in its area.

The County of London Electric Supply Co., Ltd., has applied for a Special Order for the supply of electricity in the parish of Merstham.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to *Power* the Muscle Shoals Hydro-Electric Co. has applied to the Federal Power Commission for a licence to construct a 54-ft. dam with a power house immediately below it, on the Tennessee River, in Lauderdale and Colbert Counties, Ala. The proposed installation will have a total primary capacity of 60,000 h.p. The Mississippi Power Co. has also applied to the Commission for a licence to construct a dam and power house in the Tennessee River in Tichomingo Co., Miss., and Lauderdale County, Ala. The proposed installation will have a total primary capacity of 66,000 h.p. The electrical energy generated at these stations will be used for public utility purposes.

Whitehaven.—LOAN.—The Rural District Council has decided to apply for sanction to a loan of £2,600 for lighting the Council houses and streets at Thornhill by electricity. The Council proposes to take a supply of electricity from the Cumberland Waste Heat Co.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—A *Reuter* message from New York states that a technical commission has favourably reported on the tube scheme put forward by the Anglo-Argentine Tramway Co., and an *ad referendum* agreement was signed by the company's manager and the Mayor of Buenos Aires, but before any contract is finally accepted it must be passed by a number of municipal bodies. The actual sum involved in the contract is estimated at £10,000,000 sterling, but any expenditure will necessarily be spread over a period of years. It is further stated that the Argentine Post and Telegraph Department will spend 500,000 pesos for the construction of an underground system of cable tubes.

Ashton-under-Lyne.—RAILLESS CARS.—A railless car service between Ashton and Oldham was inaugurated on August 26th. The route extends for over three miles, and the cost of the scheme, including the purchase of ten cars, was £30,000.

Australia.—NEW SOUTH WALES RAILWAY ELECTRIFICATION.—The work of widening the tracks and providing electrical equipment is proceeding rapidly. The *Industrial Australian and Mining Standard* states that four sub-stations are now under construction at Sydney Station Yard (Prince Alfred Park), Sydenham (Meeks Road), Hurstville, and Sutherland, and are to be completed in readiness for the opening of the Illawarra section which has been scheduled for January 1st, 1926. At these sub-stations the h.p. a.c. supply from the White Bay power house will be converted to 1,500-V d.c. and supplied by feeders to the overhead wire. At Prince Alfred sub-station, the equipment will consist of three 4,500-kW rotary converters with automatic starters, and with electrically-operated remote control switches for operating the feeder circuits. Meeks Road sub-station will be equipped with three 3,000-kW double-unit converters, each consisting of two 1,500-kW machines in series. The other features will be similar to those at Prince Alfred sub-station. In addition, this station will function as feeder to those at Hurstville and Sutherland, and for this purpose two 5,400-kVA transformer banks are being installed. The h.p. supply from the power house will be stepped up to 33,000 V for transmission to Hurstville and Sutherland, the whole of this equipment being of the outdoor type. Hurstville sub-station will be equipped with one 3,000-kW and two 1,500-kW converters. At Sutherland sub-station the equipment will consist of two double-unit 1,500-kW converters. The converters and switchgear are being supplied by the Australian General Electric Co. and Metropolitan-Vickers, Ltd.

Brazil.—NEW ELECTRIC RAILWAYS.—It is reported that an agreement is about to be entered into between the Government and a German group of financiers, who propose the construction of a new network of railways consisting of four lines, all to be electrically operated. The whole of the necessary material will be supplied from Germany, and German engineers alone will be employed on the work of construction.—*Reuter's Trade Service* (Rio de Janeiro).

Continental.—CZECHO-SLOVAKIA.—Orders for the first electric locomotives required in connection with the electrification of the Czecho-Slovakian State Railways have recently been placed. The Skoda Works, of Pilsen, is to supply three express and two shunting engines, the Ceskomoravska Kolben Works, Prague, five goods locomotives, the Krizik Co., Prague, two passenger engines, and the Adamstal Co. and Siemens Co. each two shunting locomotives.

AUSTRIA.—The first section of the electrified Vienna Metropolitan railway—that between Hutteldorf-Haiking and Alserstrasse—was recently opened for traffic. The total

length of the line to be electrified is 16½ miles, along which there are 25 stations or stopping places. The line is on the overhead system with double conductors, and was installed by the Austrian Siemens Schuckertwerke, of Vienna. The cars are each provided with two motors of 90-100 h.p. The necessary current for the operation of the line is supplied from the Vienna municipal central station, this being converted to 750 V d.c. by means of four mercury rectifiers. A feature of the installation is the provision of a travelling rectifying station to meet occasional heavy demands for energy. This was built by the "Elin" Gesellschaft für Elektrische Industrie, Vienna, and comprises a 750-V oil-transformer and a 700-kW, 750-V, d.c. rectifier, together with the necessary switches and measuring gear. The transformer car can be run to any desired point, provision being made at various places for connecting up both to the 5,000-V a.c. mains and to the line conductors.

HOLLAND.—ONE-MAN CARS.—A number of one-man controlled tramcars have recently been put in service on the municipal tramway system in Amsterdam. The vehicles are operated on the system of the Bergmann Elektricitatswerke Gesellschaft, Berlin. One man acts as both driver and conductor; all passengers enter by a door at the front end of the car and dismount by one at the rear, the doors being electro-mechanically opened and closed.

Cuba.—HAVANA.—A concession for the construction of the subways in the city of Havana was granted by the Cuban Government seven years ago, but the world sugar crisis of 1920 affected the economic condition of Cuba so greatly that the project has been held in abeyance. With the return of more favourable conditions in that country, the Cuba North and Southern Railroad Co., which holds the concession, is taking steps to carry out its programme. The present plans of the company call for tubes similar to the East and North River subway tubes of New York. These will extend under Havana harbour, and will connect the city with rapidly developing suburbs. The subways are expected to involve an eventual expenditure of hundreds of millions of dollars.—*Electric Traction.*

Leicester.—NEW ROUTE.—The Corporation proposes to construct a new tramway from Uppingham Road to the Coleman Road estate. A portion of the track will be laid on sleepers with crossings at various places for ordinary traffic. The cost of the scheme is estimated at £12,500.

London.—PROPOSED "GOODS" TUBE.—According to the daily Press an Anglo-American company proposes to construct an underground electric goods railway for London. The scheme would link all the principal railway termini and serve all the principal markets and trade centres. About 69 miles of track would be laid, and work would be provided for 55,000 men for three years. The estimated capital cost of the scheme is £32,000,000.

NEW "UNDERGROUND" PLANT.—Additional strain upon the present electricity supply of the London underground railways will shortly be caused by the opening of several new stations and escalators. To ease it new sub-stations will be built at South Wimbledon and Balham, and a semi-automatic station at Lambeth North. The last will have two 1,500-kW rotary converters. A new 2,000-kW rotary converter will be placed in Victoria sub-station, and another of 1,500 kW in Baker Street sub-station. A new 15,000-kW turbo-generator is to be installed at Lot's Road power station.

METROPOLITAN DISTRICT RAILWAY ORDER.—The Minister of Transport has approved an application of the Metropolitan District Railway Co. for an Order authorising it to acquire land in the borough of Westminster for works in connection with its undertaking.

South Shields.—PROPOSED NEW ROUTE.—The Corporation has asked the borough engineer and tramway manager to report on the question of extending the tramway along Sea Road.

Telegraph and Telephone Notes.

Australia.—TELEGRAPH AND TELEPHONE SERVICES.—The result of the year's working of the Postmaster-General's department for the twelve months ended June 30th, 1924, shows a telegraph income of £1,481,455 and a telephone revenue of £3,601,023, while radio receipts amounted to £15,599. In the telephone service, says the Melbourne *Herald*, many exchanges were placed in continuous day and night service, resulting in a considerable increase of staff. Last year 47,000 miles of new aerial wires were brought into service, for 46,624 net new telephone subscribers. The aerial mileage showed an increase of 20.8 per cent., making a total of 272,000 miles, and the percentage increase of new instruments was 14.6 on a total number of 318,000. The 46,624 new instruments cost an average of £60 each for apparatus and fixing. The capital expenditure from loan money on new telephone and telegraph works was £3,980,000. At the end of June, 1924, the outstanding number of applicants for telephone service was 12,341. By June this year this number had been reduced to 8,500, despite a progressive increasing demand of 5,000 a month. Amongst the causes of the financial balance being on the wrong side of the ledger were reductions of £80,000 through alteration of trunk call charges, and of £18,000 through reduced cable rates.

China.—TELEGRAPH SERVICE.—According to a report recently issued by the Chinese Government Bureau of Economic Information, there are now 84,837 miles of telegraph lines in operation in China.

International Telegraph Conference.—PARIS MEETING.—Mr. Stanley J. Goddard, vice-president, and Admiral C. P. R. Coode, C.B., D.S.O., general manager in Europe, of the Western Union Telegraph Co., left for Paris on August 31st, to represent the company at the International Telegraph Conference, which is meeting there this week after, says *The Times*, an interval in its gatherings of not much less than 20 years. The British Post Office was to be represented by six delegates. The union deals with international telegraph regulations, and was to have before it over 1,100 propositions, coming from most of the countries in the world, mainly of a detailed technical kind. The union comprises practically all the countries of the world, with the exception of the United States and Canada.

New Zealand.—SHIPS' RADIO REGULATIONS.—New regulations governing the installation of radio apparatus on vessels registered in New Zealand have been gazetted. They are intended to minimise the danger of coastal voyages, and the date of their operation is January 1st, 1926. A full explanatory statement has been issued by the Minister for Marine (Mr. G. J. Anderson), who states that every ship which carries more than 25 persons will be required to carry radio apparatus, although certain exemptions are provided for.

Radio-Telephony at Sea.—LIGHTSHIPS AND LIGHTHOUSES.—The Port Director of Basrah, Mesopotamia, has ordered three further Marconi radio telegraph and telephone installations of the YB1 type, similar to those recently installed on the dredgers *Liger* and *Tigre* at Basrah. Similar sets of equipment are being fitted by Marconi's Wireless Telegraph Co. for the Northern Lighthouse Board, in the Sule Skerry and Monach lighthouses, and also at Stromness. A third group of Trinity House stations, based on Yarmouth, is being equipped also with YB1 telephone apparatus. Groups previously fitted with this apparatus are the light vessels based on Ramsgate (the Goodwins) and Harwich. The steam vessel *Argus*, belonging to Trinity House and based on Yarmouth, will also carry the same type of equipment, together with a wireless call bell, which device is already carried by the *Alert* of the London group. These installations will make a total of 31 British lightships, lightvessels, and harbour authority offices fitted with Marconi radio telephone equipment. The YB1 installation needs a power supply of 100 watts, and has an approximate range of 50 miles for telephony and about 130 miles for continuous-wave telegraphy. The sets are designed for use as portable and semi-portable stations.

Radio Notes.

Australia.—LICENCES.—The number of licences granted in the various States are, according to the *Electrical Engineer* of Australia and New Zealand, as follows:—New South Wales, 33,964; Victoria, 19,481; Queensland, 1,211; South Australia, 2,895; Western Australia, 3,427; and Tasmania, 540. A sum of £113,658 has been collected in licence fees, and the amounts paid to the various broadcasting companies are said to be as under: 2 FC, £34,629; 2 BL, £12,018; 3 LO, £14,444; 3 AR, £4,090; and 6 WF, £4,220.

Broadcasting Development.—PER CAPITA STATIONS.—Our French contemporary, *Radio Electricité*, points out that the United States has now 5.1 broadcasting stations for each million of the population. Sweden follows with 2.2 stations for a similar number, South Africa 1, Holland 0.78, Great Britain 0.49, Norway 0.45, Belgium 0.3, Rumania 0.17, Germany 0.14, Spain 0.087, and France 0.077. It should be remembered, however, that the figures do not form a true guide to the development of the broadcasting movement in the respective countries as the transmitting power of the stations, and consequently the number of listeners served, varies considerably.

Copyright.—A B.B.C. INJUNCTION.—In the Vacation Court, on August 26th, before Mr. Justice Finlay, motion was made by Mr. Jenkins, K.C., on behalf of the British Broadcasting Co., Ltd., for an injunction to restrain the Wireless League Gazette Publishing Co., Ltd., from infringing the copyright in programmes printed in its weekly, *Radio Times*, by reproducing them in *The Wireless League Gazette*, the defendants' weekly organ. Mr. Jenkins explained that the programmes were prepared six weeks in advance, and submitted that they were compilations coming within the protection of the Copyright Act, 1911. Mr. Macgillivray, for the defendants, contended that there was no copyright in programmes which were simply records of arrangements made; alternatively, if there was copyright, it was of so flimsy a character that what the defendants had done did not amount to infringement. The amount of skill required in a compilation protected by copyright was absent. Counsel further argued that the partial reproduction of the programmes came within the exceptions to the operation of copyright law as being "fair dealing for the purposes of newspaper summary." His Lordship said 35 per cent. of the programmes in the *Radio Times* had been copied. He was satisfied that there was a real question to be argued at trial. He would make no order on the motion, and there would be liberty to apply for speedy trial of the action.—*Daily Telegraph.*

Jugo-Slavia.—NEW STATION.—Apparatus for the broadcasting station near Zagreb has, says *Commerce Reports*, been ordered from Germany on reparations account and will be installed by Jugoslavenski Siemens, the local representatives of the Siemens-Schuckert Werke. The station is to be used solely by the State, but it is hoped that later it will be released for general use. There are now 145 receiving sets in Zagreb.

Manchester Wireless Society.—TEST TRANSMISSION.—From September 2nd the testing station G6MX of the Manchester Wireless Society will transmit regularly on the following wavelengths at the times stated:—On Saturdays from 6.30 to 7 p.m., G.m.t., on 45 metres; on Sundays from 7 to 7.30 p.m., G.m.t., on 90 metres; and on Wednesdays from 5 to 6 a.m., G.m.t., on 25 metres. Reports should be sent to the hon. secretary, Mr. Y. W. P. Evans, 66, Oxford Road, Manchester. Special tests can be arranged, and members of the Society are prepared to report on reception from any part of the world, while experimenters willing to co-operate in tests on 3 to 5 metres should notify the secretary as early as possible. The Society is prepared to try any commercial apparatus in its various short-wave tests, the apparatus being returned on completion of the test with a full report.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Adwick-le-Street.—Urban District Council. September 14th. Internal wiring for electric lighting of Council houses. (August 21st.)

Australia.—MELBOURNE.—October 7th. Victorian Government Railways. Two electric transporters complete. (AX.2303.)*

Electricity Commission of Victoria. 6,600-V and l.p., lead-covered and armoured cable. (See this issue.)

Commonwealth. October 27th. Timing clocks and calculagraphs. (August 21st.)

P.M.G.'s Department. October 27th. Telephone transmitters and parts.*

November 10th. Telephone receivers and parts.

Belgium.—September 23rd. Ministry of War. 4,500 km. of field telephone cable.*

Birkenhead.—September 17th. Mersey Railway Co. Stores, *viz.*:—Electrical sundries, &c., and metallic and carbon filament lamps and fittings. Form of tender from Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

Brentford.—September 22nd. Board of Guardians. Electric wiring, &c., at the Institution, Warkworth House, Isleworth. (See this issue.)

Devizes.—September 10th. Corporation. Installing electric lighting in Town Hall. (See this issue.)

Edinburgh.—September 7th. Electricity Supply Department. Electric lighting installations at 288 houses under the Gorgie housing scheme. Specifications from engineer's office.

Egypt.—CAIRO.—September 15th. Director-General, Mechanical Department, P.W.M., Cairo. Six generating sets for steamers for the Government workshops, Bulag.

Gainsborough.—October 17th. Urban District Council. Generating plant, mains, transformers, and meters. (See this issue.)

India. — September 15th. Madras and Southern Mahratta Railway Co., Ltd. Telegraph line materials, copper wire, &c. (August 21st.)

India Stores Department. Accumulator and alkaline cells. (See this issue.)

London.—H.M. OFFICE OF WORKS.—September 15th. Supply of electrical and mechanical engineering labour-in-daywork in Cardiff. (August 28th.)

September 24th. Electric wiring installation at the White Wing, British Museum. (See this issue.)

BERMONDSEY.—September 9th. Board of Guardians. Six months' supplies of electric lamps. Forms of tender from Mr. H. H. Reeve, Clerk to the Guardians, 283, Tooley Street, S.E.1.

WESTMINSTER.—September 9th. Board of Guardians. Electric lamps, fitting, &c. Forms of tender from Mr. W. J. Leckley, Clerk to the Guardians, Guardians' Offices, Princes Row, S.W.1.

METROPOLITAN ASYLUMS BOARD.—October 7th. Installation of a fire-alarm system at Tooting Bec Hospital. (See this issue.)

ISLINGTON.—September 17th. St. Mary's Board of Guardians. Electrical supplies for six months. Mr. A. King, clerk, St. John's Road, N.19.

Newport (Mon.).—September 7th. Electricity Department. Induced draught plant, extension of flues, &c. (August 21st.)

New Zealand.—CHRISTCHURCH.—January 5th, 1926. Drainage Board. Three electric sewage pumps. (AX.2349.)*

Spain.—BILBAO.—Ministero de Fomento. Eight electric cranes for the port of Bilbao. Particulars from the Junta de Obras del Puerto de Bilbao, Bilbao.—*Reuter's Trade Service* (Madrid).

Stoke-on-Trent.—Town Council. E.h.p. testing equipment. (August 21st.)

South Africa.—JOHANNESBURG.—S.A. Railways. October 15th. Incandescent lamps.*

Warrington.—September 7th. Electricity Department. Twelve months' supply of earthenware conduits. (August 21st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—City Council. Accepted:—
6,000 100-c.p. metal filament lamps (£619).—J. Danks & Son Pty., Ltd.
Lead-covered, multi-core cables.—(£767) Enfield Cable Works (Australia), Ltd.; (£103) B.I. & H. Cables, Ltd.; (£1,356) Noyes Bros. (Melbourne), Pty., Ltd.
Single-core cables.—(£10,424) Enfield Cable Works (Australia), Ltd.; (£3,013) Metropolitan-Vickers Electrical Co., Ltd.; (£3,013) Noyes Bros. (Melbourne) Pty., Ltd.; (£314) Johnson & Phillips, Ltd.
H.p. and l.p. switchgear (£4,335).—Metropolitan-Vickers Electrical Co., Ltd.

SYDNEY.—Electric Supply Committee. Recommended:—
Bare copper cables (£13,356).—B.I. & H. Cables, Ltd.
House fuse boxes and fuses (£7,250).—B.W. Electric Co., Ltd.
Conversion of existing meters to high capacity (£737).—Electricity Meter Manufacturing Co., Ltd.

Federal Capital Commission. Accepted:—
Two motor generator sets for lifts (£1,011).—Siemens Bros. & Co. —*TENDERS.*

Dover.—Electricity Committee. Recommended:—
Cable.—Siemens Bros. & Co., Ltd.

Dundee.—Electricity Committee. Accepted:—
Piping and feed pumps, &c., in connection with new turbo-alternator at Carolina Port (£4,537).—Aiton & Co., Ltd.

Lamp Contracts.—EDISON SWAN ELECTRIC CO., LTD., has received contracts for gasfilled, vacuum, and carbon filament lamps from the Admiralty, and for inert cells from the Air Ministry.

METRO-VICK SUPPLIES, LTD., has received from the Admiralty a part-contract for Cosmos vacuum type, ordinary type, and gasfilled electric lamps.

Halifax.—Tramways and Electricity Committee. Accepted:—
Four 2,500-kVA transformers for Halifax-Huddersfield linking up scheme (£5,610).—British Electric Transformer Co., Ltd.

Heckmondwike.—Urban Council. Accepted:—
Installing electric light at 46 houses.—Urban Council Electricity Department.

Leeds.—Finance Committee. Accepted:—
Installation of electric light at premises in Park Lane (£570).—T. M. West.
Tramways Committee. Accepted:—
Feeder and telephone cables (£3,029).—W. T. Henley's Telegraph Works Co., Ltd.
60 gear wheels (£431).—National Steel Foundry Co. (1914), Ltd.
Electricity Committee. Accepted:—
Cable (£1,045), Enfield Cable Works Ltd.; (£5,523) W. T. Henley's Telegraph Works Co., Ltd.

Leyton.—Urban District Council. Accepted:—
1,700 time switches for street lighting.—Venner Time Switches, Ltd.

Northampton.—Corporation. Accepted:—
Electric lighting and central heating installation at Cedar Road School (£809).—Lowke & Sons, Ltd.

Salford.—Tramways Committee. Accepted:—
200 B.S.S. steel rails (£1,982).—Cargo Fleet Iron Co., Ltd.
Coal for six months for the Electricity Department. 2,500 tons Astley 2-in. dry slack, at 18s. per ton, delivered at Agecroft Power Station. 1,500 tons Newtown 2-in. dry slack, at 15s. 9d. per ton, delivered at Agecroft Power Station.—Clifton & Kersley Coal Co., Ltd.;
2,500 tons Agecroft dry slack, at 15s. 9d. per ton at the pit. 5,000 tons Agecroft washed fine slack, at 11s. per ton at the pit.—Andrew Knowles & Sons, Ltd.
2,500 tons No. 1 washed slack, at 16s. 8d. per ton at Pendlebury Wharf.—Bridgewater Wharves, Ltd.
2,000 tons Swan Lane washed pea slack, at 16s. 4d. per ton at Brindle Heath railway sidings.—J. B. Scholes & Sons, Ltd.
1,500 tons Starkie (Westhoughton) rough slack, at 18s. 9d. per ton delivered at Agecroft Power Station.—Peter Andrew.
2,500 tons Wilton best Cannel coal slack, at 17s. 3d. per ton, delivered at Agecroft Power Station.—Brynn Hall Colliery Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
The following tenders are recommended for acceptance in connection with a scheme for improving the lighting of the city:—
Street lamp fittings, &c.—(£3,800 and £173) South African General Electric Co., Ltd.; (£3,932 and £183) H. Davies & Co., Ltd.
Bare copper wire.—1¼ tons (£192), G. Findlay & Co., Ltd.; 1 ton (£82), A. J. North & Co., Ltd.; ½ ton (£57), Wilson & Herd, Ltd.; 10 tons (£886), Telegraph Manufacturing Co., Ltd.; 32 tons (£2,822), British General Electric Co., Ltd.; 20 tons (£1,633), W. T. Henley's Telegraph Works Co., Ltd.

Forthcoming Event.

Municipal Tramways Association.—September 9th to 11th. At Brighton. Annual Congress.

N.A.R.M.A.T. Wireless Exhibition.—Royal Albert Hall, London, S.W. September 12th-23rd.

Notes.

Educational.—We have received calendars for the day and evening classes of the Brighton Technical College for the 1925-26 session which commences on September 14th. In the day classes of the electrical engineering department, preparation courses are provided for the London University B.Sc., the college diploma, &c. Ordinary and higher certificate courses are included in the evening class syllabus. Well equipped engineering laboratories are provided. It is interesting to note that since 1922, 25 students have obtained B.Sc. degrees, including five first class and 12 second class honours, all of whom have taken two or more electrical subjects.

THE POLYTECHNIC, REGENT STREET, W.—*Electrical Engineering Department.*—The 1925-6 session will open on September 28th. Enrolments will commence on September 16th. Full particulars and prospectus can be obtained from the Director of Education. (See our advertisement pages to-day.)

Large-scale Industrial Heating.—The idea is widely held that although electricity is excellent for small furnaces, drying ovens, and other industrial heating applications, it is better to use some other agent for larger purposes. That this is erroneous is proved by many existing installations. For example, an oven measuring 10 ft. long, 6 ft. wide, and 6 ft. high is used by an American company for tempering bed springs. The oven, which was made by the Westinghouse Electric & Manufacturing Co., is of sturdy construction; it has a total loading of 60 kW and four inches of insulation to keep the heat inside. When fully loaded the oven contains about 1,800 lb. of spiral springs. Starting from cold, and fully loaded, the oven comes up to about 475 deg. F., the operating temperature, in about two hours. When empty it will reach the temperature in about 1¼ hours. Due to the efficiency of the insulation, very little heat is lost by radiation; at 275 deg. the outside is cold, while at the operating temperature it is only moderately warm. The springs are by this means very efficiently and uniformly tempered.

Inquiry into a Pit Explosion.—At the resumed inquest at Wallsend-on-Tyne on August 24th into the circumstances of an explosion at Willington Square (Edward) Pit, by which five men lost their lives, Peter Turner, a coal-cutter, said in the course of his evidence, that before the explosion he had detected gas by his lamp, but it was the end of his shift, the current was off, and he did not report it. At the time of the accident he felt a rush of air and received an electric shock. No men on his machine had been supplied with rubber gloves. He had once seen sparking when the control-box joint opened a little owing to the screws working loose with the running of the machine. Charles Lyons, a repairer, said he had received a shock from a worn, faulty cable. Some wrapping was put round the cable, which was used to the end of witness's shift. John Mayne, another miner, said he had found gas on three occasions, but had not reported it. Charles Carr, also engaged on a coal-cutter, questioned about the machine, said that on seven or eight occasions since June there had been faults found in trailing cables and the cables had been taken to bank. He had never received a severe shock. The inquiry was again resumed on August 26th. William Donald Lauder, another machine man, said that he went down the pit on the morning of the accident and received a shock while getting his machine ready. At the same instant he heard a muffled report, something struck him in the back, and he fell beside his machine. He had had shocks before but they were not similar to the one he got that morning. He had only seen his machine spark once, and that was when a stone fell on the cable and struck it. There were rubber gloves on the machine. Considerable evidence was given as to the presence of gas in the pit, which men stated they had not at times reported, and as to the examination of the pit after the explosion, also as to ventilation. A. D. Nutman, chief officer of the Houghton-le-Spring Rescue Brigade, spoke to finding the body of a machine worker named Coxon. The flesh was almost raw from severe burns. A rubber glove was on one hand and the other glove was clasped in the deceased's hand. E. Nutley, manager of Edward Pit, said that prior to the accident they had no cognisance of gas in the place. In reply to a question from the Coroner as to the cause of the explosion, witness said that in his opinion there was certainly a light from some source or other. It was something attributable to the machine, and there must have been some small accumulation of gas somewhere. In answer to a further question, witness admitted that it was dangerous to use electric coal-cutting machines where there was gas. William Toward, asked if he had seen any sparking on the machine, said "I have seen flames on the machines, never mind sparking." George Harrison, electrical engineer, said that when he examined Coxon's machine he found that the plug at the end showed slight signs of burning. He had never received any reports as to sparking on the machines. At the conclusion of the evidence, the jury returned an open verdict, stating that the cause of the explosion had not been proved.

"Wired Wireless" in Canada.—The City of London, Canada, is the first municipality served by the Hydro-Electric Power Commission of Ontario to use radio equipment for emergency communication between its transformer substations. The Commission's laboratories installed, according to the H.E.P.C. *Bulletin*, during the early part of May this year three complete guided-radio sets for the Public Utilities Commission of London in the two sub-stations at Horton and Ridout Streets, and on Cabell Street, respectively, and a third set was installed in the pumping station in Springbank Park, about four miles west of the city. The stations can communicate with each other in any of the three combinations desired, the voice signals being very pure and exceptionally loud. This "channel" does not use the telephone lines, and therefore is entirely independent of faults occurring on those circuits.

The equipment is as simple as possible; there are only two adjustments on the transmitter, namely, the filament rheostat and the grid inductance, or regeneration control, whereas the receiver has adjustable removable coils, variable condensers, and filament rheostats, to render it as flexible as possible and to allow of sharp tuning.

The transmitter and receiver are connected together through a switching system whereby either the aerial or telephone lines may be selected as the channel of communication and a transmit-receive switch is thrown alternately from one side to the other during conversation. The aerials are placed closed to the 13,200-volt power lines and are quite short. The capacity effect of the aerials to the power lines is approximately 0.001 microfarad. The one-way system has advantageous features; since it is usual on power systems to give instructions from one central point, the one-way system allows complete instructions to be sent without interruption from the station receiving the transmission. The receiving operator will listen more intently when he knows he cannot ask questions during the issuing of orders. The tuning, particularly when operating over single sections of the lines, is very broad, and signals are very loud; in consequence, the operator will receive messages clearly when only roughly tuned to the transmitting station. This radio system is supplementary to the existing telephone circuits, and both may be used at the same time, without any interference of one circuit with the other; all induced charges are drained to ground and do not produce audible sounds in the receivers.

Motor-car Battery Standardisation.—The Society of Motor Manufacturers and Traders has lately issued a data sheet, No. 123, giving dimensions for motor-car accumulators, cases, or moulded containers and for terminal posts and cable connectors. The data have been collected after many meetings of the sub-committee, and it is anticipated that the adoption of the dimensions recommended will result in considerable advantage both to the trade and the user. So far as the latter is concerned, it will mean less loss of time and expense in dealing with battery replacements and repairs. The new standards are intended to become operative on January 1st, 1926.

Institute of Metals.—For the autumn lecture, delivered at the meeting of the Institute on Tuesday last, Sir John Dewrance, K.B.E., vice-president, took the subjects of "Education, Research, and Standardisation." He reviewed the great discoveries of the century that has elapsed since railways were introduced, expressing the view that the next century would witness even greater progress, and laid stress on the importance of stimulating originality in the minds of students in order to produce discoverers. For this purpose he considered that the practice of giving advanced students research work was on the right lines. Much benefit had been derived from the formation of the Department of Scientific and Industrial Research, not only by the direct financial assistance given to research associations, but also by its bringing before the directors of industrial concerns the necessity for research and discovery. Sir John also reviewed the work of the National Physical Laboratory, and the special researches carried on by the Admiralty, the War Office, and the Royal Air Force. He held that the field for research was unlimited, and cited numerous instances in which success had been attained by this means. Standardisation, he said, was akin to research, and often research was necessary before standards could be fixed. The British Engineering Standards Association, with its 400 voluntary committees, had effected great national economies.

Very gradually the nation was raising the status of the discoverer and research worker, but many such workers were insufficiently rewarded for their labours. The object of his lecture was, by reciting what had been done, to hasten the process. The human race was in need of further education by the attainment of new knowledge and standards, and this country could not afford to fall behind others in doing its share. All who had benefited by knowledge should feel it a duty to do something for the acquisition of further knowledge.

Electricity Report of the Minister of Transport.—We have received a report respecting the proceedings of the Minister of Transport under the Electricity (Supply) Acts, for the year ended March 31st last. The report contains confirmations of the Electricity District Orders and the Special Orders made during the year. Particulars of special cases which the Minister referred to the Electricity Commissioners for their advice are also given; and a list of Orders, &c., revoked by the Minister is included. A lengthy list is given of cases where consent has been given to the erection of overhead lines.

The Minister approved an estimate submitted by the Electricity Commissioners of their receipts and expenditure during the year. This amounted to £67,000, compared with £75,000 for the previous year, comprising £43,550 in respect of the net administrative expenses of the Commissioners and £23,450 in respect of the repayment to H.M. Treasury of the third and final instalment on the advances made to meet the expenses of the Commissioners during the first two years after the passing of the Act of 1919.

Consent was given to the establishment of 12 new generating stations, the extension of 103 existing generating stations and to the establishment of main transmission lines in respect of 47 applications. The new stations sanctioned represent an initial installation of 16,700 kW of generating plant, and the extensions represent about 463,200 kW of plant.

596 applications were received from local authority undertakers for sanction to the borrowing of money, and at the beginning of the year there were 101 applications which had not been disposed of. Sanctions were granted in respect of 562 applications, and 28 were transferred to other departments or withdrawn. The total amount of the loans sanctioned was £13,364,181. At the commencement of the year 74 applications for Special Orders were before the Commissioners and 88 more were made during the year. In 66 cases orders were submitted to the Minister for confirmation, 10 applications were refused and 7 withdrawn; the remainder were under consideration when the report was made. The Commissioners approved in 26 cases of agreements being entered into between authorised undertakers for mutual assistance or for the taking of bulk supplies. Two Orders authorising undertakers to give bulk supplies to other undertakers were made and also 89 Orders permitting authorised undertakers to supply electricity to specific premises situated outside their authorised areas of supply. The Commissioners have also in 25 cases consented to the alteration of the system and/or pressure at which electricity is supplied to consumers.

Electricity and Prosperity.—Under this heading, in the *Gloucester Journal* of August 22nd, Mr. R. C. Hill, R.N.R. (ret.), criticises the fashionable advocacy of "National Electricity Supply" as the sovereign remedy for all our industrial ills, on economic grounds. He says the optimists "ignore the experience of the North-East Coast. There, as every electricity supply engineer knows, the ideal system (held up as the model for the national scheme) has been in operation for some years. 'Super-stations,' 'ring-mains,' 'linking-up,' all the familiar hackneyed terms so dear to the propagandists, are there to be found in actuality. Not only so, but the bulk of the large power users are most advantageously situated in relation to the generating stations. And yet there is no locality plunged more deeply in the morass of industrial depression at the present time than Tyneside and Cleveland on the North-East Coast.

"Then, again, the fact is overlooked that the majority of large manufacturing centres throughout the country are already adequately supplied with electrical power at rates as cheap as any obtainable under a 'national scheme.' Those districts—mainly rural—which at present have little or no supply of electricity would certainly benefit, but this would not help matters at all in the larger centres where the slump is most keenly felt; in fact, it is quite conceivable that the former would benefit at the expense of the latter, rural electrification being, at the best, a very controversial subject. . . .

"It may be argued that the State electrification schemes in progress on the Continent justify us in pushing ahead with ours. The conditions, however, are totally dissimilar, the Continental schemes being based upon harnessing huge reserves of water power, which we do not possess. . . .

"A final but very important point against a huge linked-up network is its vulnerability in times of internal or external strife. This, with the seriousness of its possibilities, is self-evident."

In conclusion, Mr. Hill says: "We must realise that the present situation is not due to a lack of cheap power in the centres of industry, but to post-war economic conditions, over many of which we have no direct control. 'National Electricity' may be a very excellent slogan, but do not let us expect it to achieve that which is not within its legitimate province."

Fatalities.—What appears to have been a practical joke ended in the death of Charles Hughes, 20, of Glasgow, employed by Messrs. Brown, Macfarlane & Co., Ltd., metal merchants, of Tollcross. During the meal hour, it is alleged, someone connected a wire from an electric light switch to the handle of a door, and when Hughes grasped the handle to open the door he received a shock which ended fatally 15 minutes later.

A lad named George Ernest Taylor was recently killed by electricity. The boy climbed one of the poles bearing a h.p. line from the Hereford Corporation electricity works to Lyde, and, coming into contact with the wires, received a severe shock and burns.

A Substitute for Brazing Spelter.—A note on "Zinc-Cadmium Alloys: Their Shear Strengths as Solders," was presented by Mr. R. B. Deeley, A.R.S.M., B.Sc., at the annual autumn meeting of the Institute of Metals, held in Glasgow, on Wednesday last. The material of this note formed part of an investigation, taken up by the British Motor-Cycle and Cyclecar Research Association, on the possibility of producing a satisfactory substitute for brazing spelter. The limits of the melting range were fixed by the fact that the working temperature of the substitute solder had to be below that likely to promote coarse crystallisation of the hard-drawn steel tubing of the frame, and further, that the melting point must be sufficiently above the enamel stoving temperature (about 180 deg. C.) for joints made with the alloy not to fail during the enamelling process. Tests of zinc-cadmium alloys in pure shear showed the strongest alloy to be near the eutectic composition. This alloy was considerably stronger than tinman's solder, 8 tons/sq. in. of alloy in shear being an average value compared with 4 tons/sq. in. for lead-tin solder in a similar joint. At a temperature of 235 deg. C., the alloy had a strength in shear of 48 lb./sq. in., and at 200 deg. C. of more than 112 lb./sq. in.

Appointments Vacant.—Cable jointer for the Eccles Corporation Electricity Department. Electrical engineering draughtsman (£315) (temporary) for the Metropolitan Asylums Board. (See our advertisement pages to-day.)

The Kent Coalfield.—In view of the prospect that the Kent coalfield will be further developed and that industries will grow up in its neighbourhood, a conference of local authorities has prepared a regional town planning scheme to ensure that the amenities of the county shall not suffer. It is anticipated that about a score of pits will be sunk, and that the annual output will be 13½ million tons of coal, and that iron and steel production will be commenced, involving an increase of population of about 400,000 persons. The scheme is drawn up with the intention of facilitating the development of mineral resources whilst preserving the agricultural activities and the natural attractions of the country side, and it is held that the new industries can be accommodated in the rural areas near Eastry and Dover, which are at present sparsely populated. An essential feature of the scheme is the generation of electricity on a large scale near the colliery, for transmission to the Metropolitan area.

The Wing-Rotor.—An interesting account appeared in *The Engineer* of August 21st of a new type of wind motor invented by Engineer-Captain Sigurd J. Savonius, of Helsingfors, and called by him the "wing-rotor." It is stated that extended trials of the device have been made, with remarkable results. The rotor resembles the two halves of a vertical cylinder attached to a vertical spindle in such a way that the inner edge of each lies in the axis of curvature of the other, and the spindle is half way between those axes. It was found that if the two inner edges coincided with the spindle, forming a letter S in plan, and the rotor was allowed to run light, the peripheral speed was equal to the speed of the wind, and if the two wings were moved farther apart, leaving a space between them, the speed was reduced. But when the overlapping arrangement above described was adopted, the air current striking the concave side of one cylinder was deflected on to the concave side of the other, the torque being thereby increased to three times that of the S-shaped rotor, and the peripheral speed rising to 1.7 times the speed of the wind. The efficiency was improved by fitting end-plates to the half-cylinders.

It is claimed that the "wing-rotor" is well adapted for driving pumps, &c., having fewer working parts than an ordinary windmill, less frictional loss, and no directing vanes. Its speed can be varied between wide limits by altering the ratio of diameter to length, and it can be made self-regulating.

Two such motors were mounted on a small boat, each wing-rotor having a width of 67 cm. and a height of 280 cm. In a breeze of 15 to 20 miles per hour, the power developed for propelling the boat was from 3 to 4 horse-power. Evidently the wing-rotor would be suitable for driving a dynamo, and should cost less than a windmill both to purchase and to maintain. It is stated that the device has been patented.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Miss WORMALD has been appointed welfare superintendent at the Bedford works of the Igranic Electric Co., Ltd.

It is announced that Mr. F. C. HIBBERD has resigned the position of managing director of Messrs. G. D. Peters & Co., and has retired from the board of that company and its associated companies.

MAJOR G. G. MALLINSON, T.D., has been appointed assistant branch engineer at Messrs. Johnson & Phillips's Newcastle office, succeeding Lt.-Col. A. P. PYNE, who has been promoted to an appointment at Charlton. Major Mallinson has been associated with Vickers, Ltd., Barrow; Siemens Bros. Dynamo Works, Ltd., Stafford; and Palmer's Shipbuilding & Iron Co., Ltd. During the war he served in France and commanded a heavy battery, and he was for some time on the artillery staff of the French Army. He has the Cross of the Legion of Honour and was mentioned in dispatches.

The marriage took place on August 26th, at the Parish Church, Ashton, of Mr. WILFRED MOODY, who is engaged with Messrs. Mirrlees, Bickerton & Day, Hazelgrove, near Stockport, and Miss HILDA ANDREW, of Ashton. Mr. Moody, before taking up his present position, was for 6½ years assistant superintendent at the Colombo (Ceylon) power station.

The Halifax Transport Committee has appointed Mr. A. E. BOYER, of Wembley, as manager of the Transport Department, at a salary of £500 per annum.

One of the Citizens' Lectures at this week's British Association meeting at Southampton was delivered by Capt. P. P. ECKERSLEY, the Chief Engineer of the British Broadcasting Co., Ltd., whose portrait accompanies this note. Capt. Eckersley, by virtue of his position and the success which the company has attained, due in no small measure to his efforts, is well known to the British public. He was born in Mexico in 1892, and left that country, after attending the Bedales School, to go to Manchester University, from which institution he obtained a certificate of technology. He then served an apprenticeship with Messrs. Mather & Platt, Ltd., and the Lancashire Dynamo & Motor Co., Ltd. In 1915 Capt. Eckersley joined the Royal Flying Corps as wireless equipment officer and served in the Middle East, Egypt, and Salonica. He was invalided home in 1916, and was appointed officer in charge of wireless training in the Southern Brigade. Later, in 1917, he proceeded to France as brigade wireless officer, but being again invalided home he joined the wireless

experimental establishment at Biggin Hill where he was responsible for experimental work in duplex telephony on aircraft. In 1919, Capt. Eckersley joined the Marconi Company as head of the experimental section of the Aircraft Department. While in this post he designed the Croydon ground station transmitter and was jointly responsible for the design of the radio-telephone set used on all modern British aircraft. He was appointed head of the experimental section of the Aircraft Department in 1921, and it was during this period that he

London] *[Maurice Beck and Helen Macgregor.*

Capt. P. P. Eckersley, M.I.E.E., F.Inst.R.E.,
Chief Engineer of the British Broadcasting Co., Ltd.

carried out the first regular broadcasting in England, from Writtle (2 MT.). Upon the formation of the British Broadcasting Company in 1923, Capt. Eckersley was appointed to his present post. He is a member of the Institution of Electrical Engineers and a Fellow of the Institute of Radio Engineers. He has been a prolific writer for the technical and popular Press and has published two excellent books for beginners in radio work. He informs us that he has no recreations and we think that we can understand why.

Obituary.—ALD. W. BRUCE.—The death has occurred at Sunderland of Alderman William Bruce, J.P., who was chairman of the Sunderland Corporation Electricity Committee from its inception, for 16 years until 1919, when he resigned owing to ill-health. It was due to Ald. Bruce's business acumen and steadfastness of purpose that the Corporation's electricity undertaking was able to develop in face of much adverse criticism.

Wills.—The late Mr. MATTHEW W. W. MACKIE, of Surbiton, principal of Messrs. W. Mackie & Co., civil and electrical engineers, left £51,268 gross and £36,279 net personalty.

Mr. GEORGE CRIGHTON, late London manager of the Western Cable Co., left £766.

New Companies Registered.

Consulting and Radio Service, Ltd. (13,790). — Private company. Registered in Edinburgh August 19th. Capital, £3,150 in 3,000 preference shares of £1 and 3,000 ordinary shares of 1s. each. Objects:—To carry on the business of consultants and advisers in relation to the erection, installation, and use of all wireless, telegraphic and telephonic, electrical, magnetic, radio-active, hydraulic, mechanical, and other instruments, &c. The subscribers (each with one shilling share) are:—G. Beveridge, 49, Keir Street, Pollokshields, Glasgow, C.A.; and Marion B. Finlay, 186, Henderson Street, Glasgow. The first directors are not named. Solicitors: Baird Smith, Clapperton & Co., 205, St. Vincent Street, Glasgow.

Vulco Dry Battery Co., Ltd. (208,026).—Private company. Registered August 22nd. Capital, £5,500 in 1,500 6 per cent. cumulative preference shares and 4,000 ordinary shares of £1 each. Objects:—To carry on the business of manufacturers of, and dealers in dry and electric batteries and all kinds of electrical appliances, &c. The permanent directors are:—W. E. Chantrill (chairman), "Aberfoyle," Keynsham, near Bristol; and G. B. Atkinson, Burwood Cottage, Hersham, Walton-on-Thames. Qualification, 100 fully-paid shares. Solicitors: Freeman, Haynes & Co., 11, Great James Street, W.C.1. Registered office: 56, Marlborough Road, Holloway, N.

Pagets Radio Components, Ltd. (208,046).—Private company. Registered August 24th. Capital, £1,000 in £1 shares (100 8 per cent. cumulative preference and 900 ordinary). Objects:—To acquire the business of manufacturing and selling machines, apparatus and articles in connection with wireless signalling, electrical, scientific and mechanical devices at present carried on by G. Paget-Usher at 4, Leysfield Road, Shepherd's Bush, and at Orchard Works, Coleville Road, Bollo Lane, Acton, together with the benefit of provisional applications filed by the said G. Paget-Usher for patent No. 30,021 of 1924 for improvements in or relating to holders for electrical coils, and patent No. 30,023 of 1924 for improvements in or relating to crystal detectors for radio apparatus, and the benefit of all designs and inventions which may be made by him in connection with wireless signalling apparatus or any electrical apparatus or device during such time as he shall be in the service of the company. The first directors are:—G. Paget-Usher (chairman), 32, Glenthorne Road, Hammersmith, W.6; and H. Vicler, 31, Seaside Road, Eastbourne, Sussex. Qualification, 10 shares. Secretary: H. Vicler. Solicitors: Watson, Sons & Room, 16, Hammersmith Bridge Road, W.6. Registered office: Orchard Works, Coleville Road, Bollo Lane, Acton, Middlesex.

Baker & Co. (Doncaster), Ltd. (207,990).—Private company. Registered August 21st. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical and mechanical engineer, manufacturer of the Baker patent piston removers and Baker patent ring compressors, and anti-dazzle devices now carried on by E. Baker at Chequer Road, Doncaster, as the "Baker Patent Piston Ring Remover Co.," and to acquire English patent No. 115,930-1917, and American patent No. 1,283,620-1918, owned by the said E. Baker, and to carry on the business of motor, mechanical, electrical and general engineers, &c. The first directors are:—Dr. E. J. Chambers, 19, South Parade, Doncaster; E. Baker, 50, Beckett Road, Doncaster; and A. Baker, 15, Glyn Avenue, Doncaster. The first two named are permanent. Qualification, £100 shares. Remuneration as fixed by the company. Solicitor: A. Loy, 3a, Hall Gate, Doncaster. Registered office: 27, High Street, Doncaster.

Reactone, Ltd. (208,013).—Private company. Registered August 22nd. Capital, £500 in £1 shares. Objects: To acquire the business of manufacturers of wireless appliances now carried on at 88/90, Chancery Lane, W.C., by F. L. Harding and R. G. E. Spawforth as "Lewis Harforth and Co.," together with the exclusive rights to use the name "Reactone," &c. The permanent directors are:—F. L. Harding, 34, Mackenzie Street, Slough; R. G. E. Spawforth, "St. Denys," The Drive, Wembley Park. Qualification, 1 share. Registered office: 88/90, Chancery Lane, W.C.2.

William Curran & Son, Ltd. (1,269).—Private company. Registered August 20th in Belfast. Capital, £4,000 in £1 shares. Objects: To acquire the business of a sanitary and electrical engineer carried on by William Curran at 58, Antrim Road, Belfast. The first directors are:—W. J. Curran, Cub-ban, Innisfayle Road, Belfast, plumber and electrical engineer; Mrs. Agnes Curran, Cub-ban, Innisfayle Road, Belfast; T. Curran, Cub-ban, Innisfayle Road, Belfast, plumber and electrical engineer. W. J. Curran shall be governing director so long as he holds 1,000 shares. Registered office: 58, Antrim Road, Belfast.

G. Lawrence & Co., Ltd. (208,106).—Private company. Registered August 28th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a radio and electrical engineer now carried on at 10, New Bridge Street, Truro, Cornwall, as "George Lawrence & Co." The directors are:—G. Lawrence, 10, New Bridge Street, Truro; P. H. Tonkin, 2, Devonshire Terrace (both permanent, subject to holding 200 shares each). Qualification of ordinary directors, 100 shares. Remuneration (except managing directors, if any) as fixed by the company. Solicitors: Nalder & Son, Truro.

Wireless Listeners League, Ltd. (208,125).—Registered as a private company August 28th with a nominal capital of £5,000 in £1 shares. Objects: To carry on the business of the Wireless League, to express the views and protect and advance the legitimate interests of users of wireless communication, to formulate suggestions and schemes for the improvement of and to organise broadcasting and other wireless programmes, &c. The subscribers (each with one share) are:—G. Russell, 37, Norfolk Street, Strand, W.C.2. solicitor; A. M. Low, 1, Woodstock Road, W.4. The first directors are not named. Solicitors: Charles Russell & Co., 37, Norfolk Street, Strand, W.C.2.

Malay and Eastern Power Development, Ltd. (208,113).—Registered as a private company on August 29th with a nominal capital of £40,000 in 10,000 "A" preference, 29,000 "B" preference, and 1,000 ordinary shares of £1 each. The objects are:—To acquire, develop and turn to account any concessions, grants, decrees, rights and powers relating to electrical or other undertakings in the F.M.S. or elsewhere. The subscribers (each with one "A" preference share) are:—Hon. Gideon Murray (Master of Elibank), 38-39, Parliament Street, S.W.1 (director of Armstrong, Whitworth (Jugo-Slavia), Ltd.); B. C. Lockhart Jervis, A.M.I.C.E., 38-39, Parliament Street, S.W.1, H. Stokes Waite, 38-39, Parliament Street, S.W.1, civil engineer. The first directors are not named. Secretary: D. C. Brook. Solicitors: Withers & Co., 4, Arundel Street, W.C.2. Registered office: 11, Ironmonger Lane, E.C.1.

Official Returns of Electrical Companies.

Will Smith, Ltd.—R. D. French, of 21, North John Street, Liverpool, was appointed receiver on August 21st, 1925, under powers contained in debenture dated May 29th, 1925.

Whitfield Electrical Co., Ltd.—Satisfaction in full on June 5th, 1925, of debenture dated March 17th, 1924, securing £2,000.

Morgan Weston, Ltd.—Satisfaction in full on July 22nd, 1925, of debenture dated December 9th, 1924, securing £400.

London and Provincial Radio Co., Ltd.—Particulars filed of £1,000 debentures authorised August 18th, 1925, charged on the company's undertaking and property, present and future, including unpaid capital, the whole amount being now issued.

Rely-A-Bell Burglar and Fire Alarm Co., Ltd. — Particulars filed of £1,000 debentures authorised July 29th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

W. J. Tough & Partners, Ltd.—Debenture dated August 4th, 1925, to secure £200, charged on the company's property, present and future, including uncalled capital. Holders: J. Wright, "Throxenby," South Heath, Bucks.; and A. E. Perkins, 81, Leagrave Road, Luton.

Petersfield Electric Light and Power Co., Ltd.—Further debenture charged on the company's property and assets, including uncalled capital and goodwill, dated August 4th, 1925, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Premier Accumulator Co. (1921), Ltd. (178,158).—Capital, £40,000 in £1 shares. Return dated July 6th, 1925. All shares taken up. £18,749 paid (£1 per share on 11,249 and 15s. per share on 10,000) 18,751 shares considered as fully paid. Mortgages and charges, nil.

Gas and Electricity Development Co., Ltd. (181,648).—Capital, £2,000 in £1 shares. Return dated December 31st, 1924 (filed July 28th, 1925). All shares taken up. £2,000 paid. Mortgages and charges, nil.

Teignmouth Electric Lighting Co., Ltd. (179,116).—Capital, £20,000 in 7,500 7 per cent. cumulative preference and 12,500 ordinary shares of £1 each. Return dated July 15th, 1925. 1,977 preference and 7,500 ordinary shares taken up. £9,537 paid. Mortgages and charges, £12,854.

Tisbury Electric Supply Co., Ltd. (176,539).—Capital, £6,000 in £1 shares. Return dated May 21st, 1925. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

Electrical Power Engineering Co. (Birmingham), Ltd. (130,377).—Capital, £5,000 in £1 shares. Return dated November 4th, 1924 (filed June 23rd, 1925). 2,445 shares taken up. £1,100 paid. £1,345 considered as paid. Mortgages and charges, nil.

D. P. Battery Co., Ltd. (44,084).—Capital, £100,000 in £1 shares. Return dated August 1st, 1925. All shares taken up. £28,000 paid. £72,000 considered as paid. Mortgages and charges, nil.

Lancashire Electric Light and Power Co., Ltd. (77,202).—Capital, £2,071,415 in 571,415 first preference, 750,000 7 per cent. preference, and 750,000 ordinary shares of £1 each. Return dated May 29th (filed August 18th, 1925. 511,440 first preference, 562,500 7 per cent. preference, and 626,500 ordinary shares taken up. £1,700,100 paid on 511,440 first preference, 562,500 7 per cent. preference, and 626,100 ordinary shares. £2,400 considered as paid on 2,400 ordinary shares. Mortgages and charges, nil.

Northern Counties Electricity Supply Co., Ltd. (67,924).—Capital, £200,000 in £1 shares. Return dated April 3rd, 1925. 149,990 shares taken up. £145,991 5s. paid (including £1 5s. on 10 forfeited shares). £4,000 considered as paid. Mortgages and charges, £188,460.

Key Engineering Co., Ltd. (76,459).—Capital, £5,000 in 4,993 ordinary and 7 deferred shares of £1 each. Return dated April 17th, 1925. 4,070 ordinary and 7 deferred shares taken up. £4,077 paid. Mortgages and charges, £5,000.

Vickers, Ltd. (3,543).—Capital, £26,500,000 in 18,000,000 ordinary, 7,000,000 cum. preference, and 750,000 5 per cent. preference shares of £1 each, and £750,000 preferred 5 per cent. stock. Return dated April 29th, 1925. Issued: 12,315,483 ordinary, 6,883,807 cum. preference, and 750,000 5 per cent. preference shares and £750,000 preferred 5 per cent. stock. Total paid and considered as paid, £20,679,290. Mortgages and charges, £1,250,000 5 per cent. first mortgage debenture stock; £2,000,000 5½ per cent. ditto, ditto; £102,122 11s. 1d. houses and land at Erith; £31,639 16s. 2d. houses and land at Crayford; £61,072 18s. 6d. houses and land at Barrow.

Avon Agricultural Co., Ltd.—Mortgage on certain land and buildings at Stratford-on-Avon, dated August 12th, 1925, to secure £1,500. Holder:—Dr. J. G. Clegg, F.R.C.S., Ashmount, Heaton Mersey.

Delhi Electric Tramways and Lighting Co., Ltd. (88,750).—Return dated July 14th, 1925. Capital, £170,000 in 140,000 preferred and participating and 30,000 ordinary shares of £1 each. 100,000 preferred and participating and 23,000 ordinary shares taken up. £100,000 paid. £9,000 considered as paid. Mortgages and charges, £36,000.

City Notes.

Reports and Meetings of Electrical Companies; Dividend Results, &c.

German Companies.

The *Emag Electricity Company*, of Frankfort-on-Main, records a loss of 45,000 marks for 1924. A great improvement in the turnover has taken place this year; the orders will provide activity until December, and prices are profitable.

The *Continental Company for Electrical Undertakings*, of Nuremberg, reports net profits of 320,000 marks for 1924-25. It is proposed to pay a dividend at the rate of 6 per cent. on the 1922 preference shares and 4 per cent. on those of 1907, the ordinary shares, which are few in number, receiving nothing.

The *Contact Company* (makers of special electrotechnical articles), of Frankfort-Rodelheim, reports a loss of 150,000 marks for 1924, most of which has been covered by an appropriation from the reserve fund. Business is now reported to show an improvement, and the turnover in the first seven months of 1925 far exceeded that in the whole of 1924.

The *Rhenish Electricity Company*, of Mannheim, states that competition in electrical constructional and installation work in 1924 became so keen that the level of prices in part fell below that in 1913. The accounts show net profits of 1,020,000 marks, permitting of the payment of a dividend at the rate of 6 per cent. on the preference, and 7 per cent. on the ordinary shares.

Belgian Companies.—The *Lampe Belge* concern proposes to double its present capital of five million francs.

La Société d'Electricité du Bassin de Charleroi has increased its capital from 14 to 15 million francs.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159, and they have been ordered to be officially quoted:—

Torquay Tramways Co., Ltd.—30,000 ordinary shares of £1 each, fully paid, Nos. 120,001 to 150,000.

Pennsylvania Water and Power Co.—A dividend of $2 per share has been declared upon the common shares for the quarter ending September 30th.

Clarke, Chapman & Co., Ltd.—An interim dividend of 2½ per cent. has been declared on the ordinary shares.

Oxford Electric Co., Ltd. — An interim dividend at the rate of 5 per cent. per annum has been declared on the ordinary shares in respect of the past half-year.

Hightown Gas and Electricity Co.—An extraordinary meeting is to be held on September 15th for the purpose of considering resolutions agreeing to the transfer of the company's undertaking to the Liverpool Corporation on agreed terms.

Davis & Timmins, Ltd.—It is proposed to pay the dividend on the 6 per cent. preference shares, and an interim dividend at the rate of 6 per cent., free of tax, on the ordinary shares in respect of the half-year to June 30th last.

Northern Mexico Power and Development Co.—A dividend of 7 per cent. has been declared on the preference shares in respect of 1924.

Brazilian Traction, Light and Power Co., Ltd.—A quarterly dividend of 1½ per cent. has been declared on the preference shares.

Stocks and Shares.

MONDAY EVENING.

THE long-expected recognition of Mexico by the British Government is at length to be accomplished. Diplomatic relations will be resumed at once. The United States "recognised" Mexico two years ago, but there was some difficulty in the way of Great Britain following suit. However, all is now declared to be well. Mexican Government, City, utility, industrial and mining issues are substantially higher in consequence. Mexican Light & Power first mortgage bonds have risen 4 points. The others are all up, though to a smaller extent. It has been more of a task, this week, to buy Mexican stock than it was to sell the same stock a month ago. The chastened tone that breathed through the recently-issued annual reports of the Mexico Tramways and the Mexican Light and Power Companies is forgotten in the newborn hopes engendered by the magic word "Recognition."

Foreign stocks and bonds are better in various cases. Brazilian Tractions have gained 4¼ points at 70½, thanks to the previously-mentioned anticipations of an increase to 5 per cent. in the dividend. Anglo-Argentine Trams have further spurted on the impression that the company is almost certain to be given the power to build subways, &c., by the Buenos Aires Municipality. British Columbia deferred stock rose 3 upon a demand of which part came from Canada. Mexicans are, as just mentioned, several points higher.

The London railway and traction group is glum by contrast with the brightness shown by the foreign section. Metropolitan Consolidated slipped back to 68. Central London Assented stock is easier, on balance, at 66 ex dividend, though Underground Electric Railways stocks are rather better.

London electricity shares make a good showing. A number of prices in this section were quoted ex the interim dividends last Thursday, and in various instances, these were recovered, either partially or altogether. Westminsters strengthened to 44s. Metropolitans are 1s. 6d. higher at 39s. 6d. City "Lights" at 48s. 3d. have gained 1s. 9d., allowing for the dividend, and Charing Cross again are better, at 49s. 6d.

Investment is turning money into the shares of the provincial power and lighting companies, on the assumption that these offer scope for appreciation as business will extend in the future. Lancashire Electrics at 26s. 6d. are 1s. 6d. up. Isle of Thanet Electrics are better at 17s. Midland Counties remain at 23s. 3d. Newcastle 7 per cent. preference picked up to 25s.

Speculation is rife as to what shape new issues are likely to assume in the London electricity companies when the capital re-organisations are completed. It is thought that future emissions of stock—after this year—may be in some company, or public body, that will act as a common corporation for the financing of the principal concerns. Possibly there may, it is surmised, be two distinct corporations, dealing with the two groups into which the London companies became divided by the Parliamentary Bills. Any such stock, or stocks, would doubtless be endowed with all the character of a gilt-edged security. Such speculation may appear to be a case, now, of beating the air, but it probably possesses a basis of shrewd and intelligent anticipation.

Cable, telephone and wireless issues are uninteresting by reason of the quietude of their quotations. Oriental Telephones are 2s. 6d. lower at 2. Automatic Telephones rose to two guineas. Great Northerns at 31¾ are 5s. better, and the Eastern group exhibits no change. Marconis can be bought at 25s. and the debenture stock is 103. Canadian Marconis have not moved from 4s. 6d. Radio Common are 10¼, the preferred shares 9¾. But the manufacturing section keeps very hard. The feature this week is a rise of 3s. 9d. in British Aluminiums, the price spurting to 35s. upon dividend anticipations which, in some quarters, are put down at 12½ per cent.; in others, at 15 per cent. In the last completed year, the company paid 10 per cent. Johnson & Phillips, after a very brief reaction, put on a florin, to 49s. 6d.

Edison Swans are up to 8s. again. English Electrics at 19s. 6d. are 9d. higher on the week. General Electric 6¼ per cent. "A" preference can be sold at the middle price of 23s. 6d. The ordinary advanced 2s. to 28s.; a modest demand found the market to be short of shares. Brush are better at 23s. 3d. Siemens hold their rise at 30s. The iron, steel and engineering section is still disposed to dulness. Rubber shares have further hardened in consequence of the strength displayed by the raw material. People are very sensibly buying shares, where these can be obtained, of the better-class £1 variety: there is not so much of the striving-for-threepences as there was in the madness of six weeks ago.

Share List of Electrical Companies

	Nom.	Dividend. 1923.	Dividend. 1924.	Price Aug. 31, 1925.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.	£					
Bournemouth and Poole	1	13	14	3	—	4 13 4
Brompton Ordinary	1	10	10	1⅞xd	+1/-	*5 14 3
Charing Cross Ordinary	1	14½	15	49/3	+9d.	6 1 3
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	12	1⅝	—	6 8 0
City of London	1	15	15	46/3xd	+1/9	6 4 4
do. do. 6% Pref.	1	6	6	22/-xd	+6d.	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	58/9	—	5 2 0
do. do. 6% Pref.	1	6	6	21/-	—	5 4 4
Edmundson's Ordinary	1	7	7	22/-	+1/-	6 7 3
do. 7% Pref.	1	6	7	21/6	—	6 10 3
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12⅝	—	5 18 8
Lancs. Light and Power	1	7½	7½	26/6	+1/6	5 15 5
London Electric	1	10	10	35/6xd	+1.6	5 12 2
do. do. 6% Pref.	5	6	6	5½xd	+½	5 7 10
Metropolitan	1	10	11	39/6	+½	5 11 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	23/3	—	5 4 4
Newcastle-on-Tyne Ordinary	1	6	7	23/3	+£d.	6 0 5
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	+6d.	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	14¼	+¼	6 8 11
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	1¼xd	+£d.	5 12 0
Urban Ordinary	1	4	4	17/-	—	4 14 2
do. 6% Pref.	1	6	6	19/6	—	6 3 1
Westminster Ordinary	1	15	15	44/-	+6d.	6 16 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/-	—	5 10 6
HOME RAILS.						
Central London Ord. Assented Stock	4	4	66xd	—	6 1 3	
Metropolitan	4	5	64	—	½ 7 7 1	
do. District	3½	3½	44½	—	7 17 4	
Underground Electric Ordinary	10	Nil	Nil	2½	+¼	Nil
do. do. "A"	1/-	Nil	Nil	7/-	—	Nil
do. do. Income Bonds	6	6	99	+1	*6 1 3	
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref. Stock	6	6	103½	—	5 15 11	
do. Def.	1½	1½	24	—	6 5 0	
Automatic Telephone	1	3	6	42/-	+9	2 17 2
Chili Telephone	5	6	5	5½	—	*4 11 0
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 15 11
Eastern Tel. Ord.	Stock	10	10	173½	—	*5 15 11
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 14 1
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	22	31¼	+¼	6 18 6
Indo-European	25	7	8½	41½	-1	*5 2 5
Marconi	1	10	10	1¼	—	8 0 0
Marconi Marine	1	10	7½	17/6	—	8 11 6
Oriental Telephone Ord.	1	12	12	2	—	½ *6 0 0
United R. Plate Tel.	5	8	8	7¼	—	5 8 6
Western Telegraph	10	10	10	16½	—	*6 3 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅞	+⅛	8 0 0
do. do. 2nd Pref.	5	6	6	8¾	+¼	8 17 10
do. do. 5% Deb. Stock	5	5	7½	+2	6 12 5	
British Electric Traction Ord.	6	6	114	+1	5 5 3	
do. do. 6% Pref.	6	6	105	—	5 14 3	
Brazil Traction	100	4	4	70½	+1½	5 13 6
Brit. Columbia Elec. Rly. Pcc. Stock	5	5	88½	—	5 11 9	
do. do. Preferred	90/-	90/-	85½	—	*5 12 6	
do. do. Deferred	120/5	129/5	100½	+3½	*5 18 3	
do. do. Deb.	4½	4½	77½	—	5 9 8	
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	4/6	—	Nil
London United Tram. Deb. Stock	4	4	42½	—	9 8 4	
Mexico Trams, 5% Bonds	—	5	5	64	+2	8 1 3
Mexican Light Common	100	Nil	Nil	27	+2	Nil
do. Pref.	100	Nil	Nil	57	+1	Nil
do. 1st Bonds	—	5	5	65½	+4	7 12 8
Yorkshire (West Riding)	1	5	—	18/9	+⅛	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	2⅞	—	*4 13 4
British Aluminium Ord.	1	5	10	1⅞	+⅛	5 14 3
British Elec. Transformer Pref.	1	Nil	7	17/6	—	—
British Insulated Ord.	1	15	15	3⅞	—	4 12 4
Brush Ord.	1	10	10	23/9	+9d.	1.8 12 0
Callenders	1	15	15	3¼	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	1	—	—
Edison-Swan	4/-	10	10	+/-	+6d.	5 0 0
do. 5% Deb. Stock	5	5	80½	—	6 4 3	
Electric Construction	1	10	10	30/6	—	6 11 ½
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/6	+9d.	5 2 7
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6¼	6¼	23/6	—	5 10 8
do. Ord.	1	5	7½	28/-	+2/-	5 7 2
Henley	1	15	16	3¼	—	4 18 6
do. 4½% Pref.	5	4½	4½	4½xd	—	5 6 0
India-Rubber	1	5	5	2/-	-6d.	*4 10 11
Johnson & Phillips	1	10	10	4/6	+2/-	3 14 9
Met-Vickers, Ord.	1	8	8	24/-	—	6 10 8
do. Pref.	2	8	8	2¼	—	6 14 9
Siemens Ord.	1	—	7½	1½	+⅛	5 0 0
Telegraph Construction	12	27	20	26½	—	4 10 0

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price September 1st.	Fortnight's Inc. or dec.
a Acid, Oxalic per lb.	6¾d.	—
a Ammoniac, Sal per ton	£60	—
a Ammonia, Muriate (large crystal) "	£52	—
a Bisulphide of Carbon "	—	—
a Borax "	£25	—
a Copper Sulphate "	£25 10s.	—
a Potash, Chlorate per lb.	4d. to 4½d.	—
a " Perchlorate "	5½d.	—
a Shellac per cwt.	£15 15s.	—
a Sulphur, Commercial "	£7 15s.	—
a " Roll "	£7 15s.	—
a Soda, Chlorate per lb.	2½d. to 3d.	—
a " Crystals per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks per lb.	4d.	—
METALS, &c.		
b Aluminium, Ingots per ton	£120 to £125	—
b " Wire per lb.	1/9 to 2/6*	—
b " Sheet "	1/6 to 2/-	—
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£229	£10 dec.
Grade II " "	£164	£5 dec.
Grade III " "	£95	—
c Brass (rolled metal 2" to 12" basis) per lb.	9¼d.	—
c " Tubes (solid drawn) "	1/- to 1/0½	—
c " Wire, basis "	10½d.	—
c Copper Tubes (solid drawn) "	1/1½	—
c " Bars (best selected) per ton	£92	£1 dec.
c " Sheet "	£92	£1 dec.
c " Rod "	£92	£1 dec.
d " (Electrolytic) Bars "	£67 10s.	5s. dec.
d " Sheets "	£143 10s.	—
d " Wire Rods "	£77 10s.	5s. dec.
d " H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod "	2/3 to 2/3	—
f Sheet "	2 3to 2/6	—
n German Silver Wire "	2/3	—
h Gutta-percha, fine "	2/9	—
h India-rubber, Para fine "	3/1 to 3/2	—
l Iron Pig (Cleveland Warrants) per ton.	nom.	—
l " Wire, galv. No. 8, P.O. qual. "	£21	—
g Lead, English Pig "	£40	£1 inc.
g Mercury per bot.	£13 10s. to £13 15s.	2s. 6d. dec.
e Mica (in original cases) small per lb.	3d. to 2/-	—
e " " medium "	4/- to 8/-	—
e " " large "	10/- to 20/- & up.	—
p Phosphor Bronze, plain castings "	1/3½	—
p " " drawn bars & rods "	1/3	—
p " " rolled strip & sheet "	1/2½	—
p " " wire "	1/3½	—
e Platinum per oz.	£36	—
d Silicium Bronze Wire per lb.	1/0½	—
r Steel, Magnet, in bars "	7½d.	—
a Tin, Block (English) per ton.	£250 5s. to £250 15s.	£6 10s. dec.
" Wire, Nos. 1 to 18 per lb.	3/11	—

*1 or 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Denny & Co.

The London Electrical Engineers.—27th A.A. Battalion, R.E. (T.A.).—Honorary Colonel: Col. R. E. B. Crompton, C.B.; Officer Commanding, Lieut.-Col. C. H. S. Evans, O.B.E., A.M.I.E.E. The following orders have been issued for September:—

304th Company (Major W. H. Merrett, T.D., A.M.I.E.E.).—Mondays, 7 p.m. to 9.30 p.m. Completion of training for the year ending October 31st, 1925.

305th Company (Major A. W. Mawby, O.B.E., A.M.I.E.E.).—Tuesdays, 7 p.m. to 9.30 p.m., from September 15th, for completion of training.

306th Company (Major F. C. Clarke, A.M.I.E.E.).—Fridays, 7 p.m. to 9.30 p.m., from September 18th, for completion of training.

The battalion finishes the annual camp on September 13th. The 304th Company left Watchett on Sunday, August 30th, after a fortnight of very indifferent weather; much valuable work was done, but with four stations manned only, the camp duties were unusually heavy, owing to the small numbers in camp with only one company. It is earnestly hoped that many of those who enjoyed camp, despite the weather and heavy work, will bring along recruits to the unit, which will largely ease up the duties when in camp in future. Twelve lights will be manned by the Battalion at the British Empire Exhibition, Wembley, throughout the month.

Headquarters, at 46, Regency Street, London, S.W.1, will be open until 8 p.m. on weekdays and 1 p.m. on Saturdays. The address of the officers' mess will be at headquarters from September 13th.

The Reorganisation of Krupps.—The Berlin correspondent of the *Financial Times* says that the Friedrich Krupp A.G., Essen, is negotiating for the sale of certain assets, including the electrotechnical building department, the fine mechanical workshops and the textile-spinning machine factories, all of which have proved unremunerative in their present form. The remaining works are again to be reorganised.

The British Association.—II.

The Southampton Meeting.

THE opening of the proceedings of the Association was accompanied by variable weather, but this did not deter visitors from proceeding on the interesting itinerary which had been arranged for them. There was a very large attendance at the inaugural meeting to hear Dr. Lamb's presidential address, and it was announced that the Association had definitely decided to accept the invitation to meet in Oxford next year with the Prince of Wales as president.

Dr. Lamb prefaced his address with a few remarks upon the nature and purpose of science in general. He claimed that it was disinterested investigation and the arrangement of facts into an intelligible scheme. If the material effects of any discoveries were such as to work harm to the human race, or if they did not produce anticipated benefits, science could not be held responsible.

The proceedings on August 27th were outlined in our last issue. Taking advantage of a lack of matter of electrical interest in the morning, a visit was paid to the Pirelli-General Cable Works, which are situated conveniently near the heart of the town. Here were seen many interesting processes, some of which we hope to describe and illustrate in a subsequent issue. On the afternoon of the same day, a visit was paid by members from the Engineering Section to the Southampton Docks. Particular attention was paid to the electricity supply and electrical equipment there which formed the subject of a paper by Mr. H. Wauchope, the Southern Railway Co.'s electrical engineer at the docks, which was presented to the Engineering Section on the following day. Other papers read before this Section on the same day were "The Quay Walls of Southampton," by Mr. F. E. Wentworth Shields, O.B.E.; and "The Electrical Power Station at Southampton," by Mr. W. G. Turner, the Borough Electrical Engineer. There was also a joint discussion with Section B.—Chemistry—upon the ignition of gases, to which Prof. H. B. Dixon, F.R.S., Prof. W. T. David, and Dr. O. C. de C. Ellis contributed. Prof. Dixon described a number of experiments carried out for the Safety in Mines Research Board. In the Mathematical and Physical Science Section, Prof. A. E. Kennelly read a paper upon "Some New Properties of Hyperbolic Functions and Integral Series of Numbers, with Applications to Electrical Engineering." The president of Section F—Economical Science and Statistics—(Miss Lynda Grier) delivered her address, dealing with "The Meaning of Wages." In this the vexed question of "fair wages" was discussed and the effect of low wages upon the community considered. In the same Section, Mr. R. F. Harrod read a paper on "The Trade Cycle and the Theory of Distribution," showing that where there were fluctuations in the system of distribution of products among the factors of production, the volume of production would probably fluctuate also, causing periods of prosperity or depression.

On Saturday evening a Citizens' Lecture was delivered at the Avenue Hall by Prof. E. V. Appleton, who dealt with "The Rôle of the Atmosphere in Wireless Telegraphy." The week end proved fine, and a number of excursions to places of recreation and interest, of which there are many within easy reach of Southampton, were arranged. On Monday last a paper on "High Efficiency Steam Installations for Ship Propulsion" was presented to the Engineering Section by Mr. S. S. Cook. This paper made special reference to the use of auxiliary machinery, four classes being dealt with, *viz.*, steam-driven, steam-electric, Diesel-electric, and mechanically-driven from the main engine. On the same morning Mr. C. le Maistre read a paper upon "Engineering Standardisation," emphasising its importance and reporting upon progress. In the Chemistry Section, Mr. J. A. V. Butler read a paper on "The Seat of the Electromotive Force of the Galvanic Cell," and Mr. E. A. Ollard presented another describing experiments upon electro-deposited chromium to determine its resistance to corrosion. On the evening of the same day Capt. P. P. Eckersley, whose portrait appears in our "Personal" column, delivered a Citizens' Lecture upon "Some Technical Problems of Broadcasting."

On Tuesday last Prof. H. Bateman, in the Mathematics and Physics Section, read a paper entitled "The Force on a Spinning Electron." Two papers on radio matters were presented before the same Section, "Some Thermionic Valve Problems," by Prof. E. V. Appleton, and "The Study of Wireless Wave Fronts by Directional Methods," by Dr. R. L. Smith Rose. Prof. J. J. Nolan dealt with "Atmospheric Ionisation." The only matter of electrical or allied interest which was raised on the concluding day (Wednesday) was a demonstration by Prof. J. G. Gray of gyroscopic apparatus for the use of engineering students.

During the meeting an invitation to Leeds in 1927 was received and accepted by the Council. The 1928 meeting will probably be held in Glasgow.

The Southampton Electricity Undertaking.

By W. G. TURNER, A.M.I.E.E.

(*Abstract of Paper read before Section G.—Engineering.*)

ELECTRICITY was first supplied to Southampton in 1891 by the Southampton Electric Light and Power Co., Ltd., which obtained a Provisional Order in 1895, the area being the county borough as then constituted. In 1896 the Southampton Corporation purchased the undertaking, and the power station, in the centre of the town area, was re-built and extended. This station, by reason of the limitations of the site, could not be extended sufficiently to deal with the rapidly growing demand, and, moreover, was unsuitable for the economical generation of power, there being no railway or water facilities. Consequently, a site of about four acres of mudlands on the foreshore of the River Test, was reclaimed, and in 1903-04 a large new station was built on piled foundations. This station is close to the centre of the load, has an adequate supply of cooling water for condensing purposes, a railway siding connecting it to the Southern Railway over which coal is obtained, together with ample room for the disposal of ashes, and has been gradually extended in size until in 1920 it contained generating plant of 9,000-kW capacity. Since then it has been modernised and enlarged. Three machines aggregating 1,300 kW, and practically obsolete, were removed, and two machines aggregating 11,000 kW substituted, making the present generating plant capacity 18,760 kW. The station as now laid out, is capable of accommodating plant of upwards of 65,500-kW capacity. The size of the boiler house which is arranged parallel to the longitudinal axis of the engine room, has been doubled by adding an additional row of boilers parallel with the existing row, there being a common firing floor between the two rows. Its ultimate size is 275 feet long by 114 feet wide. Already a machine of 10,000-kW normal capacity, the first of five machines of this size, to be placed in the extended engine room, is on order for installation next year; this will make the station the largest in the Southern Counties. All machines recently installed have their shafts at right angles to the longitudinal axis of the building, as will also future machines (see fig. 1). A 50-ton electrically operated overhead travelling crane is to be installed.

The coal consumption is now upwards of 33,000 tons per annum, and is rapidly increasing. Coal wagons are hauled from the Southern Railway Company's Southampton West Station sidings by the Corporation's electric locomotive, and are unloaded by means of a grab, capable of lifting half a ton, operated from an electric jib railway crane. The grab delivers the coal into a receiving hopper provided with a chute from which it gravitates through an automatic filler to an endless chain gravity bucket travelling conveyor capable of handling about 20 tons of small coal per hour. Some of this plant will shortly be inadequate and is to be replaced by an electrically-rotated wagon tippler with hand operated clamping gear, capable of dealing with from 12 to 15 wagons per hour each carrying 12 tons. The coal will be delivered into a receiving hopper provided with a chute leading to the automatic filler of an endless chain gravity bucket conveyor capable of handling 80 tons of small coal per hour, and a chain speed of from 55 to 60 feet per minute. The whole of the new plant

is being supplied by Babcock & Wilcox, Limited. The old coal bunkers are being removed, and new and more capacious bunkers erected. The ashes are removed in small wagons mechanically hauled along a narrow gauge track to an ash tip where they are dumped, and later they are sold.

There are five boiler feed pumps, three of which are Weir's direct acting reciprocating type, and two Weir's turbine driven rotary type. Together they are capable of delivering a total of 43,500 gallons of feed water per hour. A further turbine driven rotary type pump capable of delivering 20,000 gallons of feed water per hour is on order from J. P. Hall and Company. The water treatment plant consists of an oil eliminator and filter for dealing with the oily condensate from the reciprocating engines, and a water softener and filter.

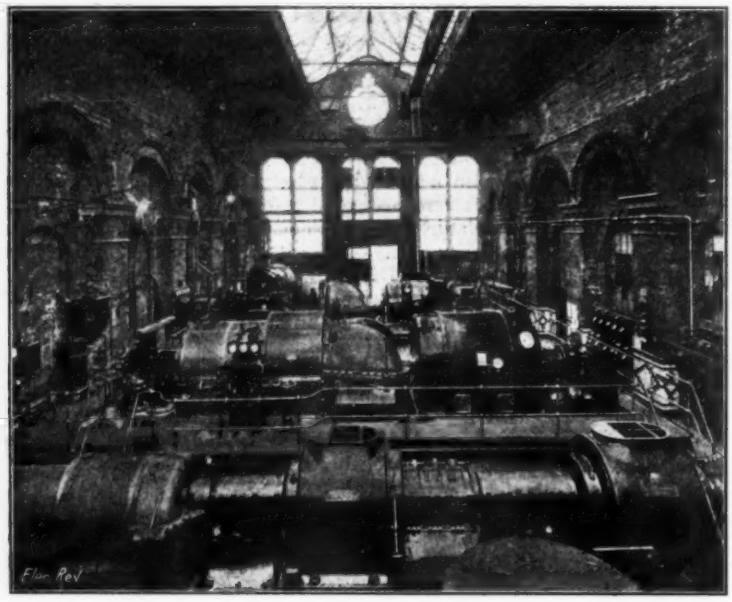


Fig. 1.—Interior of the Southampton Power Station.

There are at present installed in the boiler house, eight Babcock & Wilcox water tube type boilers suitable for a working pressure of 200 lb. per square inch above atmosphere, and having a total equivalent evaporative capacity of 274,418 lb. of water per hour. They are all fitted with integral superheaters capable of imparting a superheat of 150 deg. F. to the steam, making the total temperature 538 deg. F. The automatic stokers are all of the travelling chain grate type, one being of the Underfeed Stoker Company's make, and most of the remainder of Babcock & Wilcox double lap intersecting link type. Four boilers are fitted direct with economisers, and the remaining four discharge through a common economiser. Six of these boilers are connected to the original brick chimney. The two boilers most recently installed, discharge through separate Green's economisers behind the boilers, into a common Prat steel chimney. Each of these two boilers, in common with two previously installed and two more shortly to be erected, has a total active heating surface of 9,273 square feet, a total grate area in two grates per boiler, of 210 square feet, and an equivalent evaporative capacity of 46,780 lb. of water per hour when burning 10,500-B.th.u. bituminous coal. The total heating surface of each superheater on these boilers is 2,200 sq. ft. The economisers on each of the two boilers recently installed and the two shortly to be erected are Green's vertical cast-iron type, each with 320 pipes, capable of raising the temperature of the feed water from 90 deg. F. to 195 deg. F. at boiler pressure. Thus the temperature of the flue gases leaving the boiler is reduced from 500 deg. F. to 350 deg. F. The combined efficiency of the boiler plant on the above bases is 82 per cent. The Prat chimney works on the ejector principle. It has been decided to fit a "Cyclone" dust collector to the steel chimney for the boilers shortly to be erected.

Ultimately the boiler house will be capable of accommodating 18 large boilers with a total equivalent evaporative capacity of 842,000 lb. of water per hour, or sufficient after allowing for spares, to steam upwards of 55,000 kW of plant. Each of the boilers at present installed is provided with the usual mountings and instruments, including a CO_2 indicator. The two boilers shortly to be installed are each to be provided with a panel bearing all the necessary indicating instruments. They will also be provided with automatic feed water regulators, volumetric Lea coal meters, a combined temperature and electrical CO_2 recording apparatus for recording the flue gas temperature at the economiser outlet and the percentage of CO_2 in the boiler exit gases, a multi-point electrical distance thermometer for indicating various temperatures of boilers and economisers, and various local gauges and thermometers. It is proposed to increase the steam temperature in two stages. The decrease in steam consumption of the turbine plant with the higher temperature, will be from 12 to 15 per cent.

The station also houses a Willans and Robinson reaction type condensing steam turbine driving tandem 565/660-kW Brown-Boveri a.c. 440/530-V generators, running at 1,800 r.p.m.; two Cole, Marchent & Morley vertical triple expansion drop Corliss valve gear condensing steam engines, each driving a 1,000-kW Dick, Kerr d.c., 450/550-V generator, running at 110 r.p.m.; two B.T.-H. impulse type (Curtis) condensing steam turbo-alternator sets of 1,500-kW and 3,000-kW capacity respectively, two-phase, 2,200 V between each phase and the common return at 50 cycles per second; one Metropolitan-Vickers impulse type condensing steam turbo-alternator set of 5,000-kW capacity, three-phase, 6,600 V between phases, 50 cycles; and one Parsons reaction type condensing steam turbo-alternator set of 6,000-kW capacity as above. The whole of the plant has an overload capacity of 25 per cent. for two hours, and the alternators will give their full output at 80 per cent. power factor. The 5,000-kW turbine has an integral surface feed water heater located in the exhaust end which raises the temperature of the hotwell water coming from the main condenser, from 71 deg. to 150 deg. F. The 6,000-kW turbine already installed and the 10,000-kW machine on order, are similarly equipped. Closed-circuit cooling is employed. The 6,000-kW turbine is fitted with "end-tightened" blading in the high-pressure portion. The minimum radial clearance of this portion is about 3/16 in., whilst the radial clearance in the remainder of the blading ranges from ¼ in. up to ½ in. The danger of very fine radial running clearances is thus eliminated.

Each of the three-phase turbo-alternator sets is provided, in addition to various local instruments, with panels having suitable instruments mounted thereon to indicate all conditions. The condensers are also provided with Kent's "Venturi" water meters to measure and record the amount of condensate. A turbo-alternator efficiency indicator designed by the author and made by Nalder Brothers & Thompson, Ltd., is combined with the water meter on the 6,000-kW set. This instrument, without having recourse to highly organised simultaneous readings made by at least two observers, of various instruments situated usually in different places, and subsequent reference to the "Willans line" of the machine, indicates simultaneously the load on the alternator, and the actual as against the guaranteed total steam consumption of the turbine at that load on one instrument in the hands of one observer only. Causes of high steam consumption which might otherwise have continued unnoticed for a considerable period can thus be rectified without unnecessary and costly delay and the risk of possibly a serious breakdown can be obviated. The readings can be logged as part of the regular station routine and thus provide a continuous check on any deterioration from the guaranteed efficiency and incidentally show any improvement in the running. It has been decided to fit a similar instrument to the 10,000-kW turbo-alternator set now on order. The latter set, representing the latest practice, is of particular interest. The steam turbine is being made by Fraser & Chalmers Engineering Works and embodies improvements made as a result of the Reports of the Steam Nozzles Research Committee formed by the Institution of Mechanical Engineers and the British Electrical & Allied Manufacturers' Association. For a number of technical reasons the makers of the machine decided to apply the low steam velocity in the high-pressure part of the turbine, and the high steam velocity in the low-pressure part of the turbine. In the new design the velocity compound wheel has a small diameter and utilises a very moderate drop. As a result its steam flow efficiency is substantially higher than in the older design with a larger velocity wheel utilising a large pressure drop. Then follow a large number of small diameter single impulse stages utilising low steam velocities, instead of a small number of large diameter stages as previously. The low pressure part of the turbine is designed on similar lines to the older design, and consists of a number of large-diameter single impulse stages, except that the large mean diameter is now applied right through the low pressure part instead of in the last few stages only, in order to obtain a high steam flow efficiency in all the low pressure stages. Stages of medium diameter, which would incur medium steam velocities with lower efficiency, are entirely eliminated from the design. All the high and low pressure stages are housed in one casing, the length of the turbine being slightly increased when compared with the length of the older design. The alternator, which is being made by the General Electric Co., Ltd., and has combined axial and tangential ventilation with an external fan, will have a continuous output of 12,500 kVA, and an overload output, for two hours, of 15,625 kVA. The condenser is being made by Hick, Hargreaves & Co., Ltd., and is designed for a flow of 12,100 gallons of circulating water per minute; it will have a cooling surface of 11,800 square feet. The plant with a vacuum of 28.5 inches Hg (barometer 30 in.) will have a steam consumption at full load of 11.22 lb. per kWh, which will be reduced to 10.29 lb. when the steam temperature at the turbine stop valve is increased to 700 deg. F.

These figures include the power required for driving the alternator ventilating fan but are exclusive of feed heating and all steam and power for the condenser auxiliaries. As the "heat drop" under the more favourable conditions is 432.2 B.th.u. per lb., the thermal efficiency of the turbo-alternator from steam input to electrical output is 76.8 per cent.

The condenser circulating water system is not without interest. As the River Test recedes from the quay wall at low water by about 1,000 yd., a cooling pond capable of holding about 2,000,000 gal. was constructed adjacent to the station. This pond is replenished at each high water, and as there is a second high water two hours after the first, with only a small fall of the tide, high water lasts in effect for nearly four hours at each tide, *i.e.*, twice in every twenty-four hours.

The switch and control rooms are adjacent to the engine room on the side opposite to the boiler house. The switch room contains British Thomson-Houston e.h.p. three-phase switchgear in moulded stone cell structures. The rupturing capacity of the original oil switches is 150,000 kVA, but as this will shortly be insufficient special arrangements will be made to safeguard them. The new oil switches have a rupturing capacity of 300,000 kVA.

The control room is equipped with four main switchboards for the d.c. three-wire power and lighting system; the d.c. traction system; the two- and single-phase a.c. system; and the three-phase system.

The number of consumers connected in 1925 was 8,455, this being an increase of 182 per cent. over 1914. The total sales to private consumers were 13,542,401 kWh, an increase of 220 per cent., and the total sales to all consumers 17,909,256 kWh, an increase of 150 per cent. The total load connected was 25,664 kW, an increase of 255 per cent. There are a number of very large private consumers, including the Docks.

The Resistance to Corrosion of Electro-deposited Chromium.

By E. A. OLLARD.

(*Abstract of paper read before Section B.—Chemistry.*)

Chromium, since it was first deposited by Bunsen in 1851, has been considered as a possible metal for plating purposes. With the advent of stainless steel, a good deal of attention has been drawn to the non-tarnishable properties of chromium and chromium alloys. The chief properties of chromium are its hardness and its resistance to corrosion by the atmosphere and certain acids. It is, however, readily attacked by hydrochloric acid, and is also easily corroded when it forms the anode of an electrolytic circuit. A good deal of technical difficulty, however, was experienced in the early attempts to electroplate chromium on to other metals, and it is only within the last few years that processes have been evolved which have been satisfactory on an industrial scale. The test pieces and other objects mentioned in the paper were plated by Dr. Liebreich's process, which is being used commercially in Germany and France, and appears to give quite satisfactory results.

The object of the work described was to investigate the properties of chromium-plated material and discover for what purpose it is specially suitable. This investigation has chiefly taken the form of a comparison with other plating processes. Sufficient time has not yet elapsed for conclusive results, but it is thought that a summary of the factors or data obtained so far may prove interesting.

A number of steel test pieces were cut from a bright steel strip and a hole bored in one end to suspend them by. These test pieces were then plated in groups of nine with different metals or combinations of metals. Of these groups, three were exposed to atmospheric corrosion on the roof of a chemical laboratory, three were placed in a boiler and exposed to the action of steam, two were placed in salt spray, and one was heated in the presence of air. While chromium will not protect steel from rusting when plated on it directly, it was thought probable that if an underlying metal such as nickel or copper were first plated on the steel it might be possible to prevent it from rusting, and at the same time obtain the advantageous properties of the chromium plating. Groups of test pieces were therefore plated in the following manner:—Group 1: One hour deposited in a cadmium cyanide bath; Group 2: 3 hours deposited in a nickel sulphate bath; Group 3: 1 hour deposited in cadmium cyanide bath and 1 hour in nickel sulphate bath; Group 4: 1 hour in nickel sulphate bath and 1 hour in cadmium cyanide bath; Group 6: 1 hour in nickel sulphate bath, 1 hour in copper sulphate bath, then buffed and plated, ½ hour in nickel sulphate bath; Group 7: ½ hour in chromium bath; Group 8: ½ hour in copper cyanide bath followed by ½ hour in chromium bath; Group 9: 1 hour in cadmium cyanide bath followed by ½ hour in chromium bath; Group 10: 1 hour in nickel bath followed by ½ hour in chromium bath; Group 11: ½ hour in copper cyanide bath followed by 1 hour in copper sulphate bath; Group 12: 2 hours in nickel bath followed by ½ hour in chromium bath.

The test pieces plated in this manner were then tested as described above. They were all measured and weighed before and after the tests, and the loss of weight per unit area was calculated. Notes of the appearance of the test pieces were also kept and specimens of one of each of the groups exposed on the roof. These examinations are recorded in tables appended to the paper.

The specimens were hung from a frame on the roof of the laboratory, suspended directly above a trough of water and exposed to the Trafford Park atmosphere. The time allowed for this test was 768 hours. The nickel plated specimens were readily attacked, and showed a greenish deposit on the surface. The cadmium specimen stood fairly well, but appeared to be evenly attacked. The copper specimen was very much tarnished, and also lost a good deal of weight. In the case of the chromium deposited directly on the steel, the chromium plating was almost entirely removed, having apparently been thrown off by the corrosion of the steel underneath it. The chromium deposits, however, which had been made on copper and nickel stood quite satisfactorily, with only slight traces of local rusting. Chromium deposited on to cadmium stood remarkably well, but in some places the chromium flaked away from the cadmium coating. The chromium plating does not appear to adhere well to the cadmium and, especially in the subsequent tests which involved temperature rise, the chromium plating was almost entirely removed from the cadmium. The most satisfactory specimen from the point of view of loss in weight was that in which the steel was first coppered and then chromium plated, although those with nickel as an underlying metal also stood very well.

In the boiler test, the specimens were suspended in the steam space of a small boiler. In this case the chromium with underlying nickel proved the most satisfactory, while the nickel plating stood fairly well. The cadmium protected the steel fairly satisfactorily from rust, but lost weight, and would have been removed in time.

As chromium is attacked very violently by hydrochloric acid, it was thought that the conditions prevailing in the salt spray would corrode it very rapidly. It was found, however, that the salt spray had very much less action on the chromium plating than was anticipated. In this test the most satisfactory platings were those consisting of both nickel and cadmium. The chromium plating with nickel as an underlying metal, however, stood quite satisfactorily, losing about the same weight as the nickel plated specimens and less than the cadmium plated specimen. The copper plated specimen was very badly corroded.

One specimen of each group was heated intermittently in an oven at about 400—420 deg. C. for 150 hours of actual heating. In this case, again, the cadmium plated samples were badly attacked, and also the chromium plating on cadmium. In the latter case the chromium was almost entirely thrown off. The other chromium-plated samples all seem to stand fairly well, the surface of the plating, however, oxidising slightly. The nickel plated specimen also stood well. Another test piece of steel was made which was plated first with nickel for about an hour, then immersed for an hour in the copper sulphate bath, then re-plated with nickel for half an hour, polished and finally chromium-plated for half an hour. This specimen was exposed on the roof of the chemical laboratory for about two months, and at the end of this time was still quite bright, showing no apparent sign of rusting.

Besides the laboratory tests described above, a number of articles were chromium-plated and put into service under different conditions. As tests of this nature require a fairly lengthy period of time before any conclusion can be reached, it is not possible at present to give the results of many of these. Some of them, however, are worth mentioning. The bracket holding the wind screen mirror on a car was plated, and this has kept bright much better than the nickel plating on the rest of the car. Another important application for chromium plating has been in the protection of die casting moulds. This application was suggested by the British Non-Ferrous Metals Research Association, and a small steel pin from one of these moulds was plated with chromium. These pins are made of expensive special steel, and it is hoped that an ordinary steel, chromium plated, could be substituted for this. The pin in question has now made some 5,000 castings, and no difference in size can as yet be detected with the micrometer. A chromium-plated terminal was also exposed in Sheffield for two months under conditions where a nickel-plated terminal rapidly tarnished. At the end of this exposure the terminal was still bright and just as good as when it was first exposed. A large number of articles are being plated and placed in service under different conditions, but it will be some time before the results of these tests can be collected.

From these tests it appears that the most satisfactory plating for all round purposes is chromium with nickel as an underlying metal. Steel plated first with cadmium and then with chromium appears to stand very well against atmospheric corrosion, but has the difficulty that the chromium has a very strong tendency to strip from the cadmium. Also chromium plated on cadmium will not take a high polish. Steel articles plated first with nickel and then with chromium, especially if a layer of copper is put in between, will stand atmospheric corrosion extremely well. Composite platings of this nature may be objected to commercially on the grounds of cost. One of the chief costs of plating an article, however, lies in the setting up, cleaning and pickling processes. In the case of plating a specimen with a series of different metals, it is usually only necessary to swill the specimen and transfer it to the next bath and, therefore, the cost of the operation is not increased as much as might be expected. It seems probable that certain important applications will be found for this process in industrial practice. The test made on the die casting pin seemed to show that the process may have a big future in this industry, and it is by no means unlikely that platings of this description may find applications in chemical plant, &c.

The above tests are merely preliminary work on this subject, and it is hoped to continue tests on a more extensive scale, both in the laboratory and in service. The work was carried out in the Research Department of the Metropolitan-Vickers Electrical Co., Ltd., and the author acknowledges the assistance of Messrs. Pollitt and Mather, of the Chemical Section.

Earthquakes and Electrical Installations.

Observations of the Damage done to Electrical Plant in Japan by the 1923 Earthquake.

ALTHOUGH, of course, it was inevitable that the electrical installations in Japan could not escape damage from the great earthquake of 1923, in which over 150,000 lives were lost and 500,000 houses destroyed, little has been known till now of the extent of the injuries. An outline of a report on the investigations made by a joint committee organised by the Institute of Electrical Engineers of Japan, the Japanese Electrotechnical Committee, and the Electrical Association of Japan into the effects of the earthquake and fire, which we have received, throws some light upon the subject. The object of the report was to examine into and record the general conditions of the damage done, and to obtain data for instituting precautionary

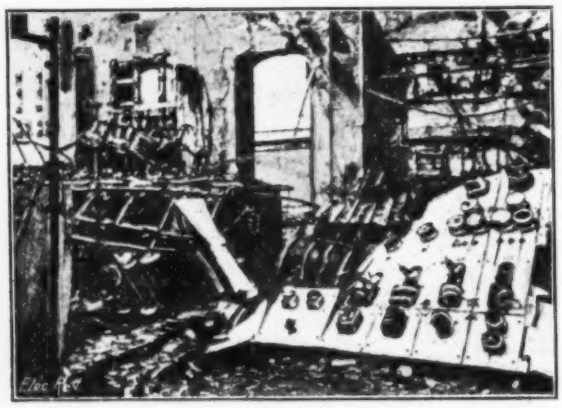


Fig. 1.—Eirakucho Sub-station, after Fire.

measures, it having been decided that if such measures had been taken, much of the loss and devastation could probably have been avoided.

It is generally known that the severity of an earthquake and its effect upon any locality depend upon the distance from the origin, the general contour of the land and its geological formation; but it is extremely difficult to record its effects precisely. Fig. 4 is a map divided into three districts, each denoting by the depth of shading the intensity of the shock, which will help in following the observations made in the report.

The injuries to the hydro-electric installations were the result of either the earthquake directly or the consequent landslides therefrom. The intake constructions were, in general, not heavily damaged; but there were a few cases where the concrete piers of the head and sand gates were cracked at the bottom. In the Katsuragawa system, where the earthquake was not severe, the only damage done to those constructions was some slight cracks in the piers, most of the other parts escaping any damage. Of the earth-fill dams, the case of the Ono reservoir in the Katsuragawa system is very interesting. The dam is 125 ft. high by 900 ft. long. The slopes are 2 to 1 inside, and 3 to 1 outside, having a puddle core at the centre. Many longitudinal cracks appeared running parallel with the dam, and reached generally vertically downward to a distance of about 50-70 ft., their width gradually diminishing and finally reduced to a hair crack. They were afterwards examined very carefully by boring in the dam, but were found to be not of any serious nature. Repairs were done by filling with a mixture of clay, sand and water as in ordinary mortar. The reservoir was then gradually filled and thereafter worked with no trouble. It is a matter of conjecture, however, what would have been the extent of the damage if the dam had been located in the more severely affected area. It may be inferred that the strength of earth-fill dams against heavy earthquakes is worthy of further investigation. Head tanks and penstocks are usually necessarily placed on mountain slopes at a very steep angle. It was natural, therefore, that the pipe lines should suffer considerable damage from landslides. In the Katsuragawa district, however, damage was less than in the Hakone district, but in one case where the side wall of the head tank had large cracks as above mentioned, pipe lines and anchorage blocks were also dislocated. Thus water gushed out from the pipe and washed away the surface of the slope and flowed into the power station.

Practically all injuries sustained by the machinery in the steam and gas power stations were the results of the sinking of foundations, the collapse of buildings or the falling of chimneys, &c. The principal reason for the severity of damage caused to the stations is that they are located near the sea shore or river banks, where the soil formation is less suitable for installing heavy machinery, for the purpose of getting better facilities for fuel handling and water supply. Boilers as a rule suffered no serious damage from the earthquake direct, but many injuries were caused by the collapse of the buildings or chimneys, &c. Two Erie-City boilers installed on Tsurumi reclaimed land, although their upper drums were situated very high and therefore seemed rather susceptible to earthquakes, were intact, due probably to the effectiveness of the struts used in the supports.

At the time of the earthquake most of the reserve plants were not in operation. In the Akabane steam power plant of the Imperial Government Railways, however, one 6,000-kW horizontal Westinghouse-Parsons type steam turbine was in operation. At the first shock the machine was stopped immediately. Oil for the bearings was supplied by an auxiliary pump. When the machine was later examined it was found that many of the turbine blades were bent, but there was no damage to the bearings. Another turbine of the same type, which was uncovered for inspection, was also damaged in a similar manner. This phenomenon may be attributed to the fact that the direction of the earthquake vibrations was along that of the machine shaft. A 7,500-kW General Electric steam turbine in the Kanagawa power station of the Tokyo Electric Light Co. was running at no load for drying the armature at the time of the earthquake. It was also immediately stopped and was found afterwards to have sustained no damage whatever.

In the Kanagawa power station, in which were installed many sets of economisers within a flue of brick construction, the flue was totally destroyed and the economisers, therein contained, were all toppled over. The economisers in the Akabane power station were placed directly behind the boilers upon a solid foundation and were contained within reinforced concrete flues, and the only damage sustained by them was a slight leak. The former installation was somewhat out-of-date, and the latter was of a new earthquake-proof type.

The pipe systems in the steam power stations almost entirely escaped damage due to their being flexibly installed. All the steam pipes, which were of steel, came out unharmed, but in some of the water piping, where cast iron was used, many cracks in the flanges and some complete ruptures occurred. In the Kanagawa station the upper part of the flange of a 20-in. suction pipe, installed for the condenser circulating pump, was broken at the neck, so that service was completely interrupted. This occurred not at the time of the great earthquake on September 1st, but during one of less intensity on January 15th, 1924. The turbine was running and the pipes were filled with water in the latter case, while in the former case the pipes were empty; the water column in the pipes might have caused the breakage. From this the necessity of supporting such pipes by stays, &c., was learned.

Considerable damage was done to the chimneys of the generating stations, and from a table summarising the injuries in this direction it is noted that of 10 reinforced concrete chimneys used in thermal power stations, only one remained undamaged, while all the steel chimneys suffered no damage.

The damage to the electrical installations in most of the generating stations and sub-stations was less, being caused mainly by the failure of buildings and other structures. The

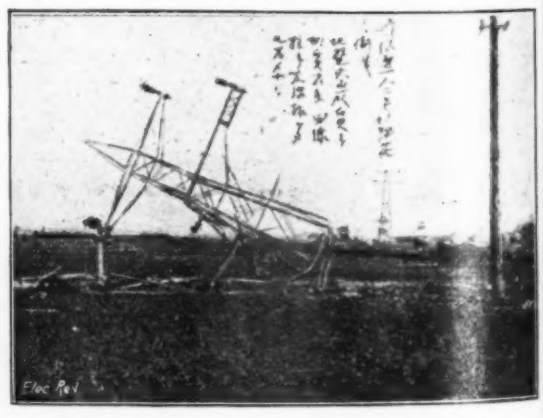


Fig. 2.—Angle Tower Overthrown by Earthquake.

foundations of the rotating machinery were generally built on solid rocks or otherwise very strong pile-work, as a result of which the machinery was not very much damaged. In some rare cases slight cracks were observed in the foundations, probably due to unsatisfactory workmanship, but in all cases these slight injuries did not prevent the machinery from operating.

In the case of the Yamura water-power station, where the building sustained somewhat severe damage, the generators and the water turbines were not affected in the least, although the generating sets were of the vertical type with shafts about 70 ft. long. No difficulty was experienced afterwards in resuming the operation of these units. Fig. 1 is a view of the

Eirakucho sub-station of the Imperial Government Railways, which was burnt down. It is interesting to note that almost all of the generating sets and water turbines in the affected area remained undamaged.

Owing to the fact that transformers are usually equipped with small rollers or wheels and that in the case of the out-door-type they are placed on rather less solid foundations, they were more or less affected. Of the transformers installed in the Oku sub-station, 15 single-phase units, 6,000 V, 3,500 kVA, were found to have moved 9 or 10 in., although the direction of the vibration was at right angles to that of wheel movement. This was probably due to the fact that the wheels were of the flat type without any flanges. In the transformers of the Tabata sub-station, the porcelain bushes were cracked, due to the transformer leads being installed without slack.

Fig. 3.—Curiously Distorted Tramway Lines.

Four 3,500-kVA transformers in the Kawasaki outdoor sub-station were tilted due to uneven settling of the foundation, thereby breaking the suspension type insulators supporting the high-pressure leads. It is also to be noted that in many cases the failure of oil and water piping caused much inconvenience in resuming the service. From these instances it should be noted that precautions should be taken to prevent any movement of transformers in the case of an earthquake.

It would require much space to describe in detail the effect of the earthquake upon oil circuit breakers, disconnecting switches and switchgear in general. In short, where the buildings containing these appliances were of the earthquake-proof type, the damage was very slight, if any, and attention must be given to the selection of a proper type of supporting material, such as fittings, insulators, bushings, &c. It is also necessary to add that some margin in slackness must be given to all leads.

It can be said in connection with installations of storage batteries that no attention has heretofore been given to providing against earthquakes, and consequently practically all the batteries installed in the affected area were disabled. Some were either overturned, dislocated or short-circuited, while others were completely destroyed, and only a very few could be immediately used for resuming the service.

Inasmuch as the immediate cause of the damage occasioned to transmission lines was landslides of the ground upon which the supporting poles or towers stood, it is needless to say that the physical conditions of the country traversed by the transmission lines should be studied carefully. Towers placed upon mountain slopes were affected in such a manner that their legs on one side slid down, and thereby caused complete collapse. But those constructed on the mountain ridges escaped any serious damage in spite of the fact that along the sides of the mountains many landslides had occurred.

The steel towers which had foundation blocks of small taper were lifted up from the ground by the vibrations of the wires, where the soil was not hard enough to hold them. Those to which a horizontal cross beam was attached at the base of the tower seem to have withstood the shocks creditably. If that part of the foot of the tower between the ground line and the cross beam was too long, it usually caused distortion and then collapse of the tower. Moreover, the earthquake shocks exposed the negligence of the workmen during construction, such as incomplete tightening of nuts, improperly prepared fittings, &c. Generally speaking, reinforced concrete poles suffered most on account of their heavy weight and lack of foundation strength. It is evident that a concrete pole once inclined is very difficult to restore to its former position because of its weight. A view of an angle tower, after the earthquake, on the Hakone system is shown in fig. 2.

All over Japan, even in the large cities, wooden poles are generally used for the purpose of supporting distribution lines, and it was found that the injuries sustained by these wooden poles were mostly the result of damage to the nearby buildings. Even in the Kanagawa and Chiba prefectures, where the earthquake shocks were severe, the direct cause of the damage was as mentioned above, except where a few poles which had rotted at the base broke off. This shows that in most cases if all buildings had been made earthquake-proof wooden poles would have suffered little damage. The high-pressure distributing line conductors (generally 3,300 V) in the affected areas failed mainly by their swaying and the consequent short-circuiting. No trouble occurred with any of the low-pressure distributing lines (210 or 105 V). Many pole transformers dropped down from their supports, but it was found that in almost all cases the transformers had neither been properly supported nor fastened. With service wires the principal difficulty seems to have been the failure of small auxiliary poles fixed to the buildings. The best way to resume the service in case of an earthquake is to disconnect immediately the faulty wires so that energy can be supplied to the unaffected consumers, and it is important that operating electric companies or corporations should train their men in ordinary times so that in any emergency proper measures shall be taken.

Tokio and Yokohama were the only cities within the affected area where underground electric cables were used; these were mostly direct-laid and very few are in ducts. In practically all cases the injuries sustained were caused either by slipping of surrounding soil or by damage to bridges supporting them. In Tokio there were no serious injuries done to the cable except in a few cases where the conductors were disjointed in the joint boxes. Manholes are generally constructed of brick work, and they all suffered more or less from cracks in the walls.

The underground transformer chambers are constructed of either steel plates or brick masonry. The steel boxes withstood the shocks but failed under the intense heat of the fire, and the brick ones nearly all developed cracks as the result of the shocks.

It is reasonable to assume that the extent of damage done to buildings is also a measure of damage done to the interior wiring. The essential condition for the protection of all interior wiring and fixtures is to build all structures earthquake-proof. To provide for emergencies in case of a great earthquake, every consumer should be taught to cut off the circuit by the incoming switch as soon as possible. In some cases it may be necessary to construct special distributing mains with underground cables to certain consumers to whom electricity supply is indispensable. It is estimated that over 1.5 million electric lamps were destroyed.

Much damage, of course, was caused by fire, and it is reported that in over 80 places fires started in the city of Tokio soon after the first shocks of the great earthquake. Whether any of these fires were the result of damage to electrical installations is a matter of great importance. From experience gained by emergency measures taken after the disaster, it was found that fires due to electricity were very rare. The first measure was to provide lighting in order to quieten the alarmed populace. On the afternoon of September 3rd, power was supplied to the reserve pump motors of the City's waterworks. The plan of action taken by the Bureau of Electricity, Ministry of Communications, in this direction was as follows:—To disconnect all service wires from the demolished and leaning houses; to supply electricity at first for street lighting and then for the unaffected private residences; and to proclaim to all consumers the necessity of economising in the use of electricity.

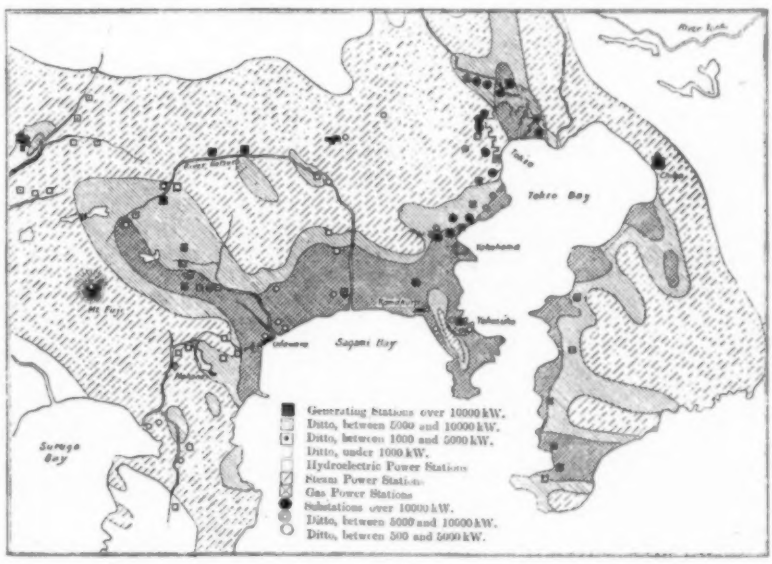


Fig. 4.—Affected Area; Depth of Shading Indicates Severity of Shock.

Simple minor injuries to the service wires and house wiring were repaired as soon as they were discovered, but owing to the chaotic conditions which prevailed at the time, there were many instances where the service wires of damaged houses were not cut, and consequently many consumers whose houses should have been cut off received a supply.

The chief troubles to the electric railways were brought about by the sinking of the road beds, &c. The most severely affected part was between the Hamamatsucho and Tamachi stations of the Government Railways, where the bed sank several feet. In Odawara, where the shocks were extremely severe, the road beds were so displaced that the tracks became wavelike in some places. These movements of the beds naturally resulted in movement of the poles and lines. In some instances railway feeders were loosened from their binding wires; but in general the injuries sustained by the aerial line were comparatively slight, so that they were all restored by the time the tracks and road beds were put in order.

A view of a deformed track in Yokohama is shown in fig. 3.

In closing the report the writer, M. Shibusawa, president of the Japanese Electrotechnical Committee and chairman of the Special Joint Committee, records the following conclusions drawn from the report:—

(1) That fire hazards from electricity can be avoided with little difficulty, if proper precautions are always taken in interior wiring and in installing appliances.

(2) Proper precautionary measures should be taken in ordinary times to interconnect the transmission systems so that in case of an emergency in one station, service can immediately be supplied from the others which are not affected.

(3) It is possible to construct sub-stations and transmission lines almost earthquake-proof. Therefore new ones should be built so, and those already built should be made earthquake-proof as soon as possible.

(4) It will be necessary to construct all communication circuits between generating stations, sub-stations, and the headquarters, earthquake-proof.

(5) It would be advisable, in the case of a large city, to construct a loop transmission line around the city, capable of being connected to all incoming transmission lines, so that in case of emergency in one incoming line others can immediately take its place.

(6) For consumers' interior wiring it is recommended to provide precautionary measures.

(7) For water supply stations, public telephone and telegraph stations, fire stations, and other public utilities which require specially quick reinstatement, independent earthquake-proof distribution lines (underground cables) are recommended.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A New Range of Oil Circuit Breakers.

We are informed by MESSRS. GEORGE ELLISON, Perry Barr, Birmingham, that they have recently marketed a new range of oil circuit breakers of the draw-out type. This switchgear is designed for use on a.c. circuits of up to 1,360-kVA carrying capacity, with a 72,000-kVA breaking capacity at 660 V, 3-phase. The draw-out feature has been adopted because it permits of quick and complete isolation and removal of the breaker from the busbars if desired and is especially useful where incoming units are installed side by side. It is also considered more economical in floor space than the "draw-out" truck type. The insulation is of specially manufactured reinforced synthetic resin which, it is claimed, will stand up to all atmospheric changes, chemical fumes, hot oils, and heating up to 350 deg. F. The breaker is of the free handle type and can be fitted with any of the usual automatic features; contact is made with the busbars by laminated sliding knife-switch type jaws. These contacts are shrouded so that there is no open space between the breaker and the busbar chamber when the circuit breaker is withdrawn. It is mounted on substantial slides bolted to the busbar chamber along which the breaker is moved by means of screws, the outward travel being limited by means of a nut which can be unfastened if it is required to completely remove the breaker. Mechanical interlocks are provided to ensure that the breaker is in the "off" position before it can be withdrawn or screwed home, and that it must be in the extreme position either way before it can be closed. The oil tank is also interlocked so that it cannot be lowered unless the breaker is withdrawn, and so that the breaker cannot be screwed home unless the oil tank is in position. The breaker lid is also interlocked with the tank so that it cannot be raised unless the tank is in the lowered position. The cable arrangements are such as to make the wireman's work as simple as possible. The usual instruments can be fitted. Fig. 1 shows an 800-A breaker drawn out from the busbars and with the oil tank lowered.

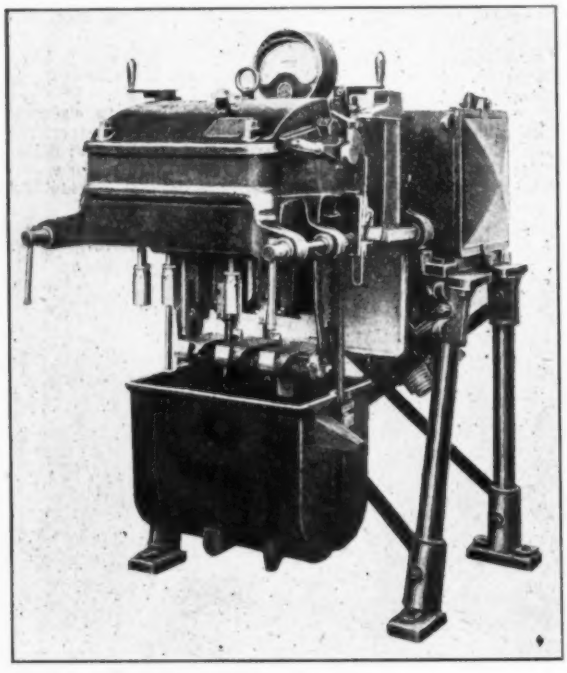


Fig. 1.—800-A Ellison Breaker.

A New Design of Small Fuse.

One of the latest products of MESSRS. EDWARD WILCOX AND CO., LTD., Cross Street Works, Lloyd Street, Hulme, Manchester, is the "Slydlok" fuse, shown in fig. 2. It is a self-contained unit designed for use in positions where abnormal vibration is experienced, the feature being a novel sliding and interlocking contact. The base contacts are of solid cylindrical form, around which the semi-cylindrical hollow holder contacts make a close fit. The holder is placed in position by inserting the contacts in the wider parts of the "T" shaped apertures in the base and pressing downwards, the holder contacts thereby sliding over the base contacts, the side walls and interior face of the base acting as guides. Curved recesses in the fuse cover allow the gases generated by a fuse rupture to escape readily. The terminal ends permit the entry of the conductors from either the ends or the back of the base, grub screws being provided for the entry holes in the terminals not in use. The contact sleeves are cut from a special extruded metal rod, afterwards subjected to a reamering process to ensure alignment and perfect contact faces.

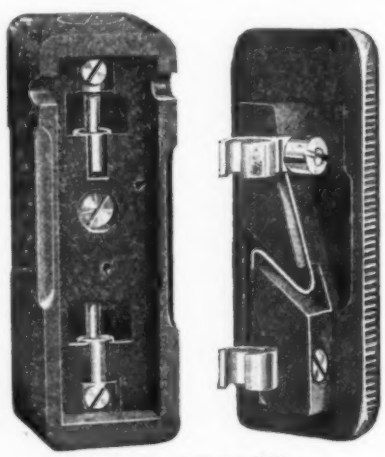


Fig. 2.—The "Slydlok" Fuse.

The fuse is made in a standard size, 10-15 A, 250-500 V. Its overall dimensions are 2¼ in. long by 1 in. wide by 1¼ in. deep. All the parts are interchangeable, and spare parts can be provided. The conductors can enter either at the back or the ends of the base; plugs are supplied for the holes at the ends, which can be used as bushes in the latter case. They can be supplied either projecting or flush with the ends of the box.

A Drilling Machine with Four Radial Spindles.

The accompanying illustration (fig. 3) is of a product of the AVEY DRILLING MACHINE CO., Cincinnati, U.S.A., recently described in *Machinery*. It is a drilling machine with four radial spindles, spaced 90 deg. apart, each being driven by a separate electric motor, which can be fed simultaneously by hand by merely operating one lever A, which is mounted on the same shaft as the pinion which drives the large ring gear B. Each head is provided with a similar pinion C engaging the teeth of the ring gear; hence a movement of this gear feeds all four pinions by an equal amount. The shafts on which

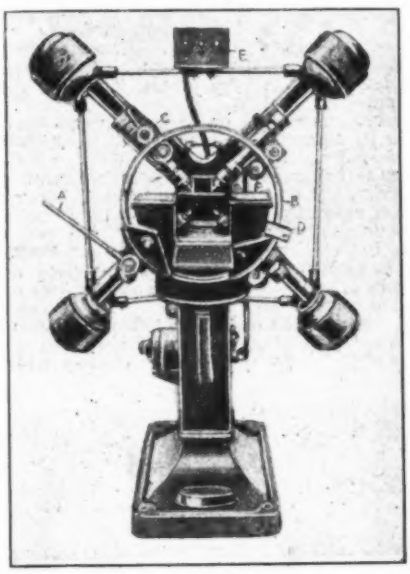


Fig. 3.—A Drilling Machine with Four Spindles.

these pinions are mounted each carry a second pinion driving the drill spindle through a rack. The forward feed of the spindles is governed by the setting of block D, while the return is controlled by a collar on one of the spindles striking the spindle head.

Two of the buttons on the upper control panel E control the individual spindle motors, each button controlling two of the motors. This arrangement allows the machine to be used in a number of ways. If six holes are to be drilled in a piece, the fixture can be indexed three times and only two holes drilled at each indexing. Each button controls the opposing spindles and the button governs the operation of the pump motor. The thrust of the pinions C on the ring gear is taken by a double-row ball bearing placed opposite each pinion as shown at F. The lower drill spindles are equipped with guards which prevent chips from getting into the spindle bearings or oil running into the motor bearings. The oil drains into a tank located between these two spindles from which it is drawn by the pump. The rotor of each motor is mounted directly on a sleeve in which the spindle slides so as to obtain a drive without intermediate gears. Two ball bearings are provided for the sleeve and one for the spindle.

Russian Electrical Notes.

Proposed Station for the Ukraine.—It is proposed to construct a new generating station to serve the needs of the industrial region of Kharkoff, the capital of the Ukraine and the centre of a big industrial district. Three schemes have been put forward, the expenditure for one being estimated at about 13,000,000 roubles. The electrical section of the State Planning Commission has decided that it is necessary to proceed with the erection of a station and has resolved that a provisional credit of 4,500,000 roubles for the purpose shall be included in the budget for 1925-26.

New Radio Station.—It is announced from Novonikolaevsk that a new Soviet radio station is being constructed at Chuguchak in Western China for meeting in the first place the requirements of the Soviet trading organisations and the Consuls.

Large Turbines. — The Leningrad Machine Trust has begun the construction of steam turbines of a pressure of 30 atmospheres, machines of this pressure not having been previously built in Russia.

The Trust has entered into a contract with the Ural Platinum Trust for the delivery to the latter of two 5,000-kW turbo-generators. These machines, it is said, will be the first of this size to be constructed at Russian works.

Electrical Extensions. — The Electric Planning Commission is applying to the State authorities for a loan for the construction of a new steam generating station, at a cost of 2,300,000 roubles, in the town of Kieff; a loan of 150,000 roubles for the erection of a new 3,000-kW turbo-generator at Archangel; and 169,000 roubles for works at Novgorod.

The Commission has also decided that a loan of 143,000 roubles shall be granted for the erection of a new 1,600-kW turbo-generator at the Omsk station; 200,000 roubles for extensions at the Krasnodarsk station; 210,000 roubles for Novonikolaieff; 200,000 roubles for the Poltoratska station; and 120,000 roubles for the Leninsk station.

Amalgamation of Trusts. — The Council of Labour and Defence has decided that the Central Electrical Trust and the Leningrad Electrical Machine Trust shall be amalgamated into a single trust. In accordance with this decision the General Electrical Commission is making arrangements with the trusts for the combination of their productive programme for 1925-26.

White Russia.—The White Russia section of the General Electric Commission is preparing information concerning the electrification of this region for submission to the Commission. In the meantime the Commission has granted out of the electrical estimates for 1925-26 a loan of 100,000 roubles to Minsk, 360,000 roubles to Vitebsk, and 200,000 roubles to the Shklovsk Spartan paper mill for electrification works.

Co-operation with Foreign Works. — With the object of utilising the experience and technical knowledge of foreign machinery works the General Metal Commission has acknowledged that it would be advantageous for the trusts and works in the metallurgical industries to secure the co-operation of well-known foreign firms. The Commission has, therefore, asked the trusts and works for information as to the kinds of production with regard to which they consider it would be appropriate to enter into relations with foreign firms, for the acquisition of drawings, projects, patents, &c.

Generator Trial.—The first large generator constructed by the Leningrad Electrical Machine Trust for the Volkhoff station was given a trial run with complete success at the station on August 4th. In all eight generators will be erected at this station, four of which have been ordered in Sweden and four in Leningrad.

Peat Fuel Station.—A trial run of the generating station at Nischni Novgorod was made on August 5th, and the station is expected to be put in operation in October. The boiler furnaces are fired with peat; the first turbo-generator is of 10,000-kW capacity, and the station will be connected with the 110,000-V line of the Electric Transmission undertaking.

A Large English Turbine.—According to the Berlin correspondent of a Moscow newspaper, the Soviet Trading Delegation in Berlin has recently had occasion to place two orders for turbines of 22,000 h.p. and 41,000 h.p. respectively, the latter being intended for the first State generating station in Leningrad. Applications were made to the largest firms in Europe for tenders for the 41,000-h.p. machine, and the decisive factor was the conditions of payment. German firms are said to have been unable to compete with English firms in this respect, and the order has consequently been given to an English works which has granted more favourable conditions, the length of the credit being stated to be five years.

Railway Electrification.—The question of the electrification of certain railways by way of a beginning is now reaching a mature stage, as the State Planning Commission, after hearing a report on the growth of the traffic on the Moscow suburban lines, which is impeding the longer distance services, has decided that it is necessary to proceed with the conversion of the Northern and Kazan lines, the White Russia-Baltic lines, and the Moscow-Kursk-Nischni Novgorod lines. With the object of making a start, the Commission, which ranks next to the supreme authority represented by the Council of Labour and Defence, has resolved to make provision in the 1925-26 budget for an allotment of 6,225,000 roubles to the Commissariat for Ways and Communications, of which the sum of 4,500,000 roubles has been assigned to the electrification of the Northern lines, and an instalment for the Kazan lines, while the balance is for preparatory works in connection with the other lines mentioned. The Commissariat for Railways has been requested to present within a month to the Planning Commission, for transmission to the Council of Labour and Defence, a plan of proposed works of conversion extending over five years in the particular order in which it is considered that the works should be carried out. Moreover, the Railway Commission has been provisionally authorised to place orders abroad for the delivery of the first series of motor cars for the Moscow region, electric locomotives for the Suram summit, and other parts of the electrical equipment. The further orders for motor cars are to be allotted to Russian works.

The Supreme Council of National Economy has presented a report to the Council of Labour and Defence, urging the necessity for the conversion without delay of the Moscow railways to electric traction and the inclusion of the requisite funds in the budget estimates for 1925-26. It is stated that it would be possible to obtain the energy from the general network of Moscow, although a further source is considered to lie in the construction of hydro-electric works on the river Malke or Bansane, which could be completed in two years.

An Improved Electric Clock System.

The "Inducta" Clock of the Stonebridge Electrical Co., Ltd.

ELECTRIC clock installations may be divided into two main classes, one in which the secondary clocks rely upon an outside source of energy (battery or supply) for their operation, and the other in which the operating energy for the secondary clocks is generated in the master clock itself. The general principle involved in the magneto clock, that employed in the latter class, is probably familiar to our readers. A magneto-

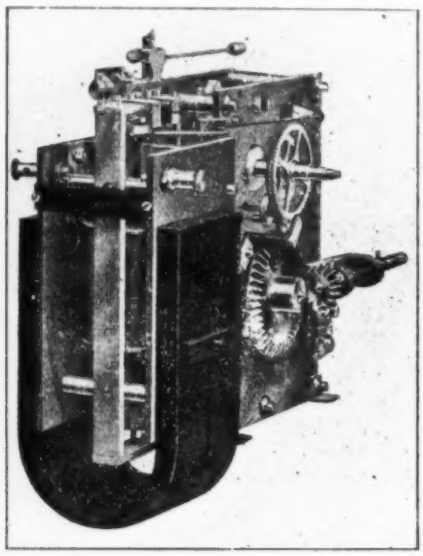


Fig. 1.—The Master Clock Magneto Element.

generator is installed in the master clock and is operated by its mechanism so that an impulse is generated at regular intervals (usually one minute), which operates the secondary clocks through suitable relays.

We were recently enabled to see some of the improvements introduced into the design of this type of electric clock by the Stonebridge Electrical Co., Ltd., resulting in the

Fig. 2.—A Tower Clock.

"Inducta" clock system. The principal advance made by the company in this direction lies probably in the introduction of the sub-master clock. This device acts as a secondary to the "master," but has installed an identical magneto-generator, enabling it to control secondary clocks in precisely the same manner. Thus by using these "sub-masters" to govern secondary circuits, any number of clocks may be included in one installation. The magneto element of the master clock is illustrated in fig. 1; the controlling element in the secondary clock is of similar construction.

A further improvement introduced into the "Inducta" clock is an automatic winding device. This operation is effected by a small electric motor, the shaft of which is connected through suitable train gear to the spindle of the winding equipment. The motor is propelled by energy from the supply mains and is controlled by means of switchgear which is brought into operation by a detent lever on the winding mechanism.

The makers standardise on the squirrel-cage motor for this automatic equipment, but will undertake to supply d.c. motors where so desired.

Another ingenious introduction is an automatic time regulating device. This is designed principally for operation on a system of recording instruments in which the recorder clocks retain their own pendulum movement, but are adjusted to accurate time at regular intervals. The sub-clocks are regulated so as to gain slightly on the master clock, and as soon as the gain exceeds a certain limit, usually two seconds, the recorder mechanism is "held up" until the clock is once more in step with the main clock. This operation is effected by the introduction of a synchronised relay into each recorder clock. A detent lever on the relay engages with the clock

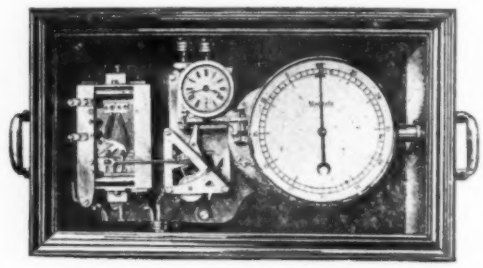


Fig. 3.—The Marine Master-Clock.

mechanism so as to arrest its movement when the limit of gain has been reached, and remains engaged until synchronism is once more obtained.

Another interesting feature is the regulating device employed in the "Inducta" marine-type master clock for use on ocean-going liners, rendering the necessary corrections, due to changes of longitude, to be made quickly by a simple adjustment. The secondary clocks are advanced by tripping the inductor of the controlling instrument, and are retarded by means of a pilot dial on the "master." By setting the period on the pilot dial, the installation is stopped for that time automatically, and upon the expiration of the period, the instruments are automatically started again. The secondary circuits can be either sub-divided or all the clocks put in series. Fig. 3 shows a marine-type master clock designed to control 50 secondary clocks.

It is evident that the possible uses of this system of electric clocks cover a wide field. One interesting application is that of the tower clock, fig. 2, which can be equipped with the inductor regulation from the ground level, and it has sometimes been found advisable to make the tower clock itself a master clock, in which case it can control additional circuits of secondary clocks.

The Late Sir Adam Beck and Canadian Water Power.—In a message to a convention of the Ontario Municipal Electrical Association and the Association of Municipal Electrical Utilities, held in June, Sir Adam Beck, whose death was announced a fortnight ago, referred to the vital importance of developing as required hydro-electric energy from the remaining water powers available in the Province of Ontario. He said: "On all sides there is a growing and more intelligent appreciation of the basic and intrinsic value that attaches to low-cost hydro-electrical energy. Control of this energy is coveted by many who would like to see it exported to the United States. One can hardly find fault with our neighbours to the South for desiring to have such a valuable commodity to aid in building up their industries and communities, but it is scarcely to be expected that Ontario citizens can be induced to part with a commodity so essential to their own necessities and welfare. What the municipalities of Ontario have accomplished through the Hydro-Electric Power Commission is so clear a demonstration of what can be accomplished by means of low-cost electrical energy that no justification exists for giving consideration to any proposal that would deprive the municipalities of electrical energy that could be utilised for the building up of the cities, towns, villages and rural communities of our own country."

Conditions in Jugo-Slavia.

A REPORT upon the economic and industrial conditions in the Serb-Croat-Slovene Kingdom (Jugo-Slavia) has been forwarded to the Department of Overseas Trade by Capt. Murray Harvey, O.B.E., M.C., British Commercial Secretary at Belgrade.*

This report says that 1924 was a bad year for industry, upon the whole. Manufacturers attribute their difficulties to a number of causes. The deflation policy of the Ministry of Finance is blamed for much of the trouble, and industrialists point out that the tariff devised for Serbia, a non-industrial country, has been adopted for Jugo-Slavia, whose needs are entirely different. Manufacturers complain that nearly all their expenses are higher than those of their foreign competitors. Money is dearer; machinery must be purchased abroad and in case of breakdowns it is sometimes months before replacements can be obtained; raw materials, fuels and other things necessary in manufacturing must be imported and stocked in large quantities; and there is a lack of skilled supervision and the Government does not encourage the immigration of skilled foremen.

Foreign Trade.

The foreign trade statistics for 1924 showed, for the first time, a good balance in favour of Jugo-Slavia. Trade with Great Britain continued to increase, this country being fourth in the list of exporters to Jugo-Slavia (after Italy, Czecho-Slovakia and Austria), having provided 10.63 per cent. of the imports during 1924. In the list of purchasing countries Great Britain is tenth, and there was a very substantial balance to this country's credit. The import statistics include electrical goods, 3,886 tons valued at 107.3 million dinars (about £357,000), and the report shows that Germany supplied electrotechnical goods to the value of 33.7 million dinars, Austria being credited with a value of 10.2 million dinars. The quantity of machines and apparatus imported is given as 15,441 tons, valued at 267.5 million dinars; of this Germany's share was 92.9 million dinars, Austria's was 68.4 million, and Hungary's 22.5 million.

The exports of Jugo-Slavia during the past year included 1,270,689 kg. of pig lead, 9,370,105 kg. of sheet lead, and 7,604,636 kg. of crude copper.

Electrical and Radio Developments.

In the province of Slovenia there is a spirit of optimism and enterprise that is lacking in other parts of the country, and much has been done towards preparing for large developments of hydro-electric schemes at Ljubljana, Fala, Ptuj, Kranj, and Maribor; it is an open secret that German industrial groups regard the province as the future manufacturing centre of Jugo-Slavia. In the Skoplje district, after keen competition, a Budapest firm has obtained the contract for the construction of a power station of 2,500-h.p. capacity at Tetovo. This station will primarily supply the lighting needs of the towns of Tetovo and Skoplje, but there will be a margin available for industry. During the year a contract was awarded (it is not stated to whom) for the electrification of Osijek (Slavonia). Considerable improvements were carried out at the port of Gruz (Gravosa). A new transit warehouse was completed and electric cranes and elevators were installed. It is stated, however, that the electrical generating plant has not yet been installed.

In the body of the report it is stated that radio-telephony cannot be said to have made great progress in Jugo-Slavia, only about 450 sets being in use. The use of private receiving sets was sanctioned in 1924 and this stimulated public interest. The majority of the sets in use are of the cheaper Austrian and German makes, but there is a certain market for English apparatus of higher quality. In an annexed report by the British Consul at Zagreb (Mr. G. T. Maclean) it is said that radio-telephony is making slow but sure progress, although the lack of a broadcasting station in Jugo-Slavia excludes the use of crystal and other simple sets. German and Swiss manufacturers carry on active propaganda, but British firms do not appear to have done much in this respect.

Trade Conditions.

In considering Jugo-Slavia as a market for manufactured goods, the comparatively low earning power of the greater part of the population, who are agriculturists, must not be overlooked. The principal demand is for goods of the cheaper qualities. The view is taken in the country that it will be to the advantage of Jugo-Slavia's economic development to eliminate Budapest and Vienna as intermediaries for foreign trade, and much has been written on the subject of establishing direct relations with countries like Great Britain with which no such relations previously existed.

Mr. Maclean says that among the methods adopted to initiate trade with Jugo-Slavia which have proved practically valueless are the sending of catalogues in English, with English weights and prices; inquiring for a representative without giving any idea as to the price of the article or the terms offered; and insisting on payment in cash against documents.

* Stationery Office. 1s. 6d.

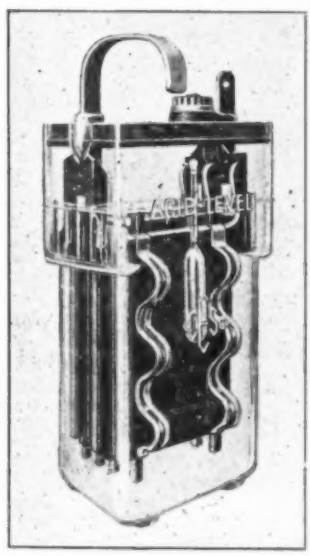
A Storage Cell of New Pattern.

The Chloride DBG and DSG Cells.

AN accumulator cell in which a number of new features are embodied is being put on the market this week by the Chloride Electrical Storage Co., Ltd. It is illustrated herewith, and from the figure it will be seen that the cell is of the glass box type, for stationary use. The purpose of the designer has been to secure simplicity of erection and of putting into service, and to facilitate the renewal of parts, besides lengthening the useful life of the cell and eliminating sources of trouble.

In the first place, separate insulators have been dispensed with, by casting feet on the glass box itself, and the box is so shaped that it is easy to carry and to set up in position on the stand (the capacity of the cells concerned ranges from 50 to 180 ampere-hours). Platforms are provided at the sides of the box, from which all the plates are suspended by lugs cast on, and glass partitions are cast in the box which definitely separate plates of opposite polarity, these partitions being high enough to do away with any risk of short-circuiting by the deposit of sludge. Provision is also made in the moulding of the box for sealing the cover.

The positive plates of the Planté type are exceptionally stout, and the negatives are of the box type; pure lead is used for the plates, and a hard lead alloy for the lugs, which, as will be seen, are dissimilar, and are so designed that it is practically impossible to connect the cells with the wrong polarity. Special consideration has been devoted to the question of assembly on site, the groups of plates being so constructed that they go together in their right places with ease and certainty, and a novel feature of the design is that the wood separators can be put in or withdrawn without in any way disturbing any of the plates. It is claimed that this object has not previously been attained in cells suitable for sealing. The groups of plates are supplied in a specially treated condition, so that the first charge need only last about 15 hours, instead of the 45 or 50 hours formerly required.



New Chloride Cell, Types DBG and DSG, from 50 to 180 Ah.

The cells, however, can be supplied in a fully charged condition, the boxes being filled with acid, and the lids sealed in place to prevent spillage of acid in transit; in this case the cells only need a freshening charge after erection, and are then ready for service.

The lids are moulded of a flexible material, and are provided with a hole for the admission of a special hydrometer, one being supplied with each battery. This instrument is of the standard shape, but the scale is marked with coloured bands, so as to indicate clearly the state of charge or discharge. The aperture in the cover is closed with a vent plug. The wood separators are prevented from rising by transverse rods which are easily secured in place.

Patents have been applied for, covering the new features, which will undoubtedly be welcomed by battery users.

A Successful Athlete.—Mr. G. R. Goodwin, of the Anchor Cable Co., Ltd., and a member of the Surrey Walking Club, has had a successful season. For the fourth year he has gained the Surrey 10-mile and 2-mile championships, and for the third year the English 2-mile championship, in addition to performing many other feats. On August 22nd he won the 3-mile inter-county walking championship of Surrey.

Electrical Trade Statistics.

THE Board of Trade has published a volume containing the latest available statistics of the external trade of a number of foreign countries and British Dominions. The periods covered vary, as do the classifications, but we have been able to extract the following information :—

Russia.—The imports of electrical machinery for the five months ended February last were valued at 756,000 gold roubles, as compared with 326,000 roubles in the equivalent period of 1923-24.

Lithuania.—The value of imported "electrical and other apparatus" for the three months ended March last was 633,000 litai, as against 765,000 litai.

Finland.—Electrical machinery imported during the first four months of the year was valued at 4,717,000 marks (6,118,000 marks).

Sweden.—Imports for the first four months of the year of copper wires and cables, sheathed with lead or other metal, 187 metric tons (610 tons). Exports of electric dynamos, motors, &c., were valued at 4,700,000 kronor (5,684,000 kr.), and of telephone and telegraph apparatus at 1,962,000 kr. (2,343,000 kr.).

Germany.—Exports during the first four months of the year :—Electric cables, 915,500 kg. (707,600 kg.); metal filament lamps (number), 7,808,000 (6,896,000).

Netherlands.—Imports for first four months of the year :—Instruments, dynamos, &c., 5,248,000 guldens (4,433,000 gld.); insulated wire and cable, 1,783,000 gld. (1,808,000 gld.). Exports of metal filament lamps were valued at 7,692,000 gld. (8,419,000 gld.).

France.—The value of electrical machinery and apparatus imported during January—April was 35,796,000 fr. (36,169,000 fr.).

Switzerland.—Exports during the first four months of 1925 :—Galvanometers, 4,207,000 fr. (3,210,000 fr.); electric dynamos, 8,723,000 fr. (7,468,000 fr.).

Spain.—Imports during the latter half of 1924 :—Dynamos, electric motors, &c., 4,014,800 kg. (2,865,500 kg.); electric wire and cables, 302,400 kg. (144,500 kg.); telegraphic apparatus, meters, &c., 156,500 kg. (83,700 kg.).

Italy.—Exports of electric wire and cable :—During 1924, 19,838,000 lire (as against 17,212,000 lire in 1923); during the first quarter of 1925, 5,482,000 lire (2,642,000 lire).

Hungary.—Trade in electrotechnical apparatus during 1924 :—Imports, 3,692,000 crowns; exports, 17,399,000 crowns.

Czecho-Slovakia.—The value of electrotechnical machinery and apparatus imported during the first three months of 1925 was 29,029,000 koruné (28,314,000 koruné).

Siam.—Electrical goods to the value of 251,000 ticals were imported during the first quarter of the year (as against 432,000 ticals).

India.—Imports during April last :—Electrical machinery, 14,69,000 rupees (19,49,000 rs.); electric wires and cables, 7,91,000 rs. (3,10,000 rs.).

Australia.—Imports during the nine months ended March last :—Covered cable and wire, £1,112,000 (£865,000); other electrical machinery and appliances, £3,696,000 (£2,736,000).

New Zealand.—The value of electrical machinery and equipment imported during 1924 was £2,056,000, as compared with £1,449,000 in 1923. The figure for the first two months of the current year was £440,000.

South Africa.—Imports during 1924 :—Cable and wire, £374,000 (£368,000); motors and parts, £175,000 (£234,000); other electrical material and machinery, £1,071,000 (£949,000).

Canada.—Imports during the first four months of the year :—Dynamos and generators, $201,000 ($469,000); electric motors, $568,000 ($697,000); incandescent electric lamps, $117,000 ($144,000).

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

7,975. "Vacuum tube illuminating devices." J. R. Robertson. March 28th, 1924. (Cognate application 11,316/24.) (237,942.)

9,253. "Thermionic indicating means responsive to light variations." J. J. Dowling. April 11th, 1924. (237,952.)

10,196. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. (Automatic Electric Co. in part.). April 24th, 1924. (237,953.)

10,764. "Insulation of conductors used in electrical apparatus." Sir C. A. Parsons and J. Rosen. May 1st, 1924. (237,960.)

11,180. "Manufacture of telegraph and telephone cables." W. S. Smith and A. D. Shuter. May 6th, 1924. (237,978.)

11,302. "Method for securing metal to insulating material." E. Y. Robinson, E. J. E. Hubbard, and Metropolitan-Vickers Electrical Co., Ltd. May 6th, 1924. (237,980.)

11,306. "Electric plug-and-socket connectors." British Thomson-Houston Co., Ltd., and H. C. Wheat. May 7th, 1924. (237,991.)

11,312. "Recording devices for use in measuring instruments, and more particularly electric meters." Landis & Gyr Soc. Anon. May 7th, 1923. (215,768.)

11,319. "Display apparatus." English Electric Co., Ltd., and H. W. Kefford. May 7th, 1924. (237,995.)

11,396. "Telephone receivers." A. E. Bawtree. May 8th, 1924. (Patent of addition not granted.) (237,997.)

11,404. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. May 8th, 1924. (238,000.)

11,430. "Apparatus for the reception and transmission of sound." G. Lakhovsky. November 29th, 1923. (225,502.)

11,443. "Thermionic valve circuits." M. M. Melinsky. May 8th, 1924. (238,003.)

11,459. "Apparatus for indicating movements or positions of machinery or parts of apparatus or the like from a distance, and for transmitting actions or signals." Knowsley Electrical Co., Ltd., F. K. Woodroffe, and R. H. N. Dawson. May 9th, 1924. (238,004.)

11,588. "Electric trolley road vehicles." J. S. Highfield and W. E. Highfield. May 10th, 1924. (238,011.)

11,678. "Electric transmission mechanism especially applicable to the propulsion of motor vehicles." E. H. J. C. Gillett. May 12th, 1924. (238,016.)

11,726. "Means for mounting insulators suitable also for other purposes." G. H. Dean and Twiss Electric Transmission, Ltd. May 12th, 1924. (238,017.)

11,786. "Former for electric inductance coils." A. J. Clitheroe. May 13th, 1924. (238,018.)

12,699. "Electrical heating of rooms or buildings." R. Grierson and Grierson, Ltd. May 23rd, 1924. (238,024.)

13,081. "Electric motor control apparatus." English Electric Co., Ltd., and T. Zweigbergk. May 28th, 1924. (238,027.)

13,324. "Means for carrying and paying-out electric cable for collectors engaging an overhead conductor." Railless, Ltd., A. E. Short, H. O. Short, and E. M. Munro. May 30th, 1924. (238,030.)

13,475. "Illuminated signs." W. J. Beville. June 2nd, 1924. (Cognate application 290/25.) (238,032.)

14,842. "Telpher or overhead transporter systems." C. W. Loveridge. June 19th, 1924. (Cognate application 7,380/25.) (238,040.)

15,115. "Means for controlling dynamo-electric machines." British Lighting & Ignition Co., Ltd., and J. C. Hutton. June 23rd, 1924. (238,045.)

15,409. "Commutating gear of high-tension direct-current apparatus." J. E. Calverley and W. E. Highfield. June 26th, 1924. (238,046.)

15,793. "Electric switches." British Thomson-Houston Co., Ltd. July 3rd, 1923. (218,653.)

16,087. "Synchronous dynamo-electric machines." E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd. July 4th, 1924. (238,053.)

16,554. "Electrical heaters." H. Grau. July 10th, 1923. (219,010.)

17,150. "Apparatus for electrical vulcanising." F. B. Dehn (Budd Manufacturing Co., E. G.). July 17th, 1924. (238,063.)

17,421. "Electrical toasting appliance." J. Lyons & Co., Ltd., and A. Goddard. July 21st, 1924. (238,066.)

18,491. "Electric switches." W. Preston. August 2nd, 1924. (238,074.)

19,945. "Inductance coils." M. J. O'Keeffe and Dickinson Electrical Manufacturing Co., Ltd. August 23rd, 1924. (238,081.)

21,735. "Electromagnetic sound-reproducers." M. C. Rypinski. March 13th, 1924. (230,780.)

22,060. "Inductance coils and insulators therefor." British Thomson-Houston Co., Ltd. September 18th, 1923. (222,134.)

22,939. "Glass-to-metal seals for vacuum tube devices." Metropolitan-Vickers Electrical Co., Ltd. September 28th, 1923. (222,508.)

22,942. "Vacuum electric tube devices." Metropolitan-Vickers Electrical Co., Ltd. September 28th, 1923. (222,511.)

26,617. "Electron discharge devices." British Thomson-Houston Co., Ltd. March 3rd, 1924. (230,011.)

27,019. "Adjustable electric resistance." S. Sokal (Wohlmuth Akt. Ges.). November 12th, 1924. (238,103.)

27,539. "Methods of cleaning up residual gases in evacuated containers and/or activating electron-emitting electrodes therein also applicable for the purification of rare gases." Westinghouse Lamp Co. December 8th, 1923. (225,838.)

28,132. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. November 23rd, 1923. (225,244.)

29,413. "Contacts for electric heating-rods." S. Sokal (C. Conradty (firm of). December 8th, 1924. (238,114.)

29,565. "Reciprocating electromagnetic motors." N. Japolsky and M. Kostenko. December 9th, 1924. (Addition to 214,393.) (238,116.)

29,913. "Circuit arrangements employing thermionic valves for the production of alternating currents." British Thomson-Houston Co., Ltd. December 14th, 1923. (226,216.)

30,526. "Thermionic triodes." General Electric Co., Ltd., and C. J. Smithells. December 18th, 1924. (238,123.)

31,346. "Electromagnetic devices." British Thomson-Houston Co., Ltd December 31st, 1923. (227,118.)

1925.

241. "Process and installation for the electrolytic extraction of tin contained in bronzes, recovering copper at the same time." O. Scarpa. January 5th, 1924. (227,125.)

289. "Electrodes for electric furnaces." Norske Aktieselskab for Elektrokemisk Indüstri Norsk Industri-Hypotekbank. January 17th, 1924. (227,822.)

2,013. "Wireless systems." Soc. Francaise Radio-Electrique. January 22nd, 1924. (228,178.)

2,285. "Flow-meters and the like." British Thomson-Houston Co., Ltd. January 26th, 1924. (228,193.)

4,054. "Electrical resistance." C. E. Scott. February 13th, 1925. (238,140.)

5,743. "Manufacture of tubular electric incandescent lamps." General Electric Co., Ltd. August 30th, 1924. (238,146.)

5,950. "Fuses for electric lamps and other devices." British Thomson-Houston Co., Ltd. March 4th, 1924. (230,461.)

7,797. "Automatic electric circuit-controlling devices." T. L. M. Millar. March 23rd, 1925. (238,151.)

10,279. "Sound connecting and transmitting devices for dictation machines and other apparatus embodying speaking-tubes or similar devices." Dictaphone Corporation. May 29th, 1924. (234,786.)

10,609. "Electric clocks." C. J. V. Fery. April 23rd, 1924. (232,975.)

10,963. "Dynamo-electric machines." O. Kraus. April 27th, 1925. (238,160.)

12,417. "Electric condensers." Wilkins & Wright, Ltd., and J. H. Hewitt. May 13th, 1925. (238,162.)

17,275. "Electric motors." Lancashire Dynamo & Motor Co., Ltd., R. S. McLeod, G. E. Mason, and W. Stansfield. March 5th, 1924. (Divided application on 236,609.) (238,169.)

Electric Smelting in Norway.—After experiments extending over some years, the Norwegian iron works, A/S Norsk Staal, has developed a new electric smelting process which, according to the Press, bids fair to lead to a revival of Norway's iron and steel industry, especially because of the abundance of cheap hydro-electric power in Norway. The share capital of the company is being increased from 900,000 to 1,350,000 crowns, of which amount 410,000 crowns has already been subscribed in Norway and in foreign countries.—*Commerce Reports.*